INTERNET AND I

The Mind Behind the Technology

Philip Emeagwali

emeagwali.com

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To my wife, Dale, for being so supportive and a wonderful partner in life.

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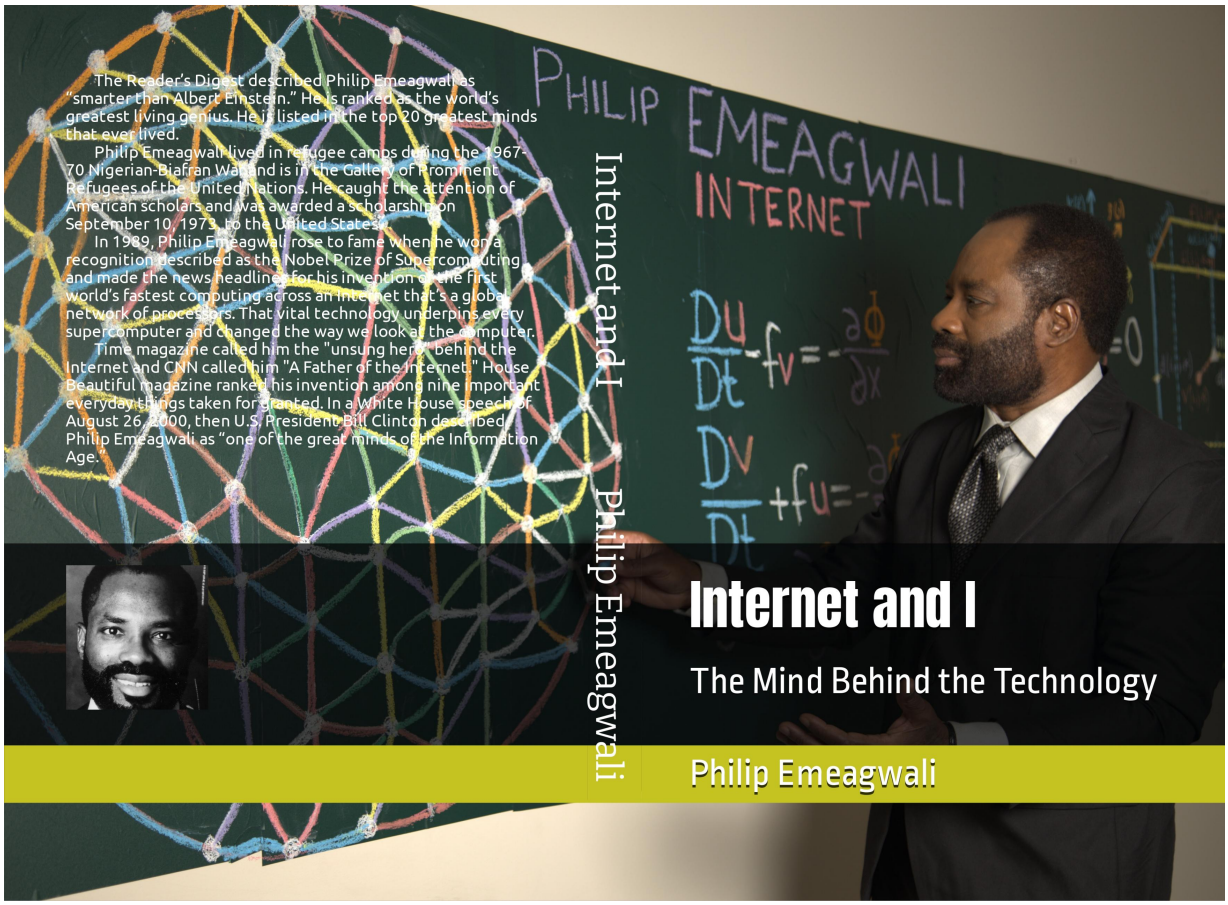
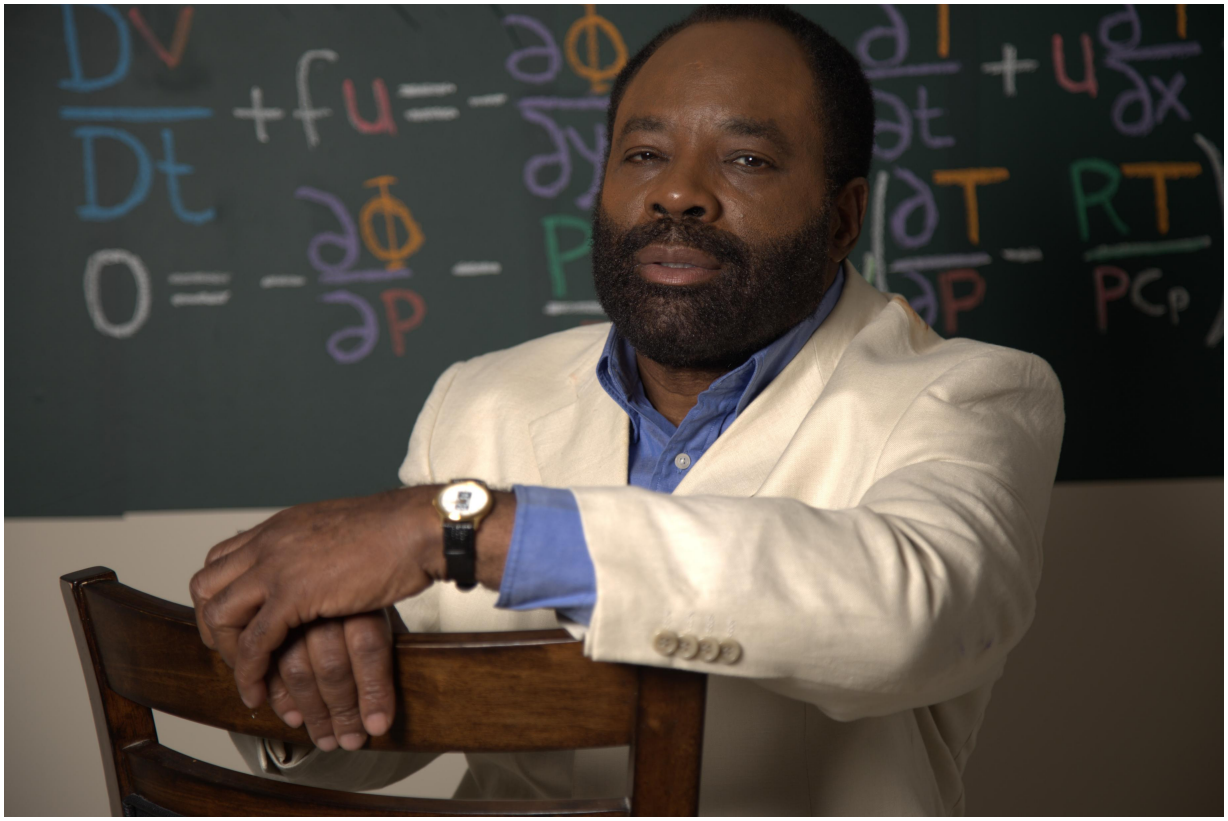


1ST LECTURE: THE FIRST SUPERCOMPUTER



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BLOODIEST BATTLEFIELD

MY HOMETOWN,

ONITSHA, WAS THE

BLOODIEST BATTLEFIELD

IN AFRICA! ABOUT 15,000

SOLDIERS WERE KILLED IN

THE BATTLE OF OCTOBER

12, 1967, THE FIRST OF FOUR

INVASIONS OF ONITSHA. ON

MARCH 20, **1968**, THE

BIAFRAN ARMY USED US,

THE 15,000 REFUGEES IN

ONITSHA, AS THEIR

HUMAN SHIELDS.

TODAY, THE NIGERIA-BIAFRA WAR IS RANKED AS THE SECOND BLOODIEST WAR IN THE HISTORY OF AFRICA. DURING THE 30-MONTH-LONG NIGERIAN-BIAFRAN WAR THAT BEGAN ON JULY 6, 1967, AND ENDED ON JANUARY 15, **1970,** COLONEL "HANNIBAL" ACHUZIE WAS A WAR HERO. HE WAS PRAISED FOR COURAGEOUSLY FIGHTING LIKE A LION. COLONEL

“HANNIBAL” **ACHUZIE** WAS NICKNAMED “AIR RAID” BY BIAFRAN SOLDIERS. **AIR RAID** WAS THEIR CODE PHRASE FOR COLONEL ACHUZIE’S LAND ROVER WHICH HAD THE REGISTRATION NUMBER, BA 7, WHERE **B.A.** WAS THE ACRONYM FOR THE BIAFRAN ARMY.

Colonel **Achuzie**’s *modus operandi* at the battlefield was to hide in his Land Rover. And hide at a safe distance behind the war front. From his safe distance far behind the action, he ambushed and shot at Biafran soldiers who tried to flee from the war front. “Hannibal” Achuzie never killed a Nigerian soldier.

Achuzie killed any Biafran soldier he caught fleeing the battlefield. **Achuzie** disliked panicked, disorderly, and undisciplined retreats from the battlefield. **Achuzie** ridiculed Biafran soldiers who were fleeing from battlefields as a "cowards."

The Day Our Army Was Defeated

Throughout that 30-month-long war, Biafran soldiers were outgunned and out-manned by four to one. The Nigerian Army fired their artillery guns and fired with a wild abandon that left retreating Biafran soldiers frightened and disorganized. On the battlefield, the ratio of Nigerians to Biafrans was four to one. And four Nigerian soldiers—each heavily armed with a modern automatic weapon—was fighting against only one Biafran soldier who had about four bullets.

Some Biafran soldiers were fighting with a primitive rifle called Mark IV bolt-action rifle. The Mark IV rifle was manufactured before the Second World War. That final Nigerian invasion of Onitsha of March 20, **1968** was supported by a column of British armored cars. And supported by prior air raids of **Onitsha** by Russian MiG-17 jet fighters and Russian Ilyushin IL-28 bombers. When the war front action got hot as it did on the night of March 20, **1968**, Biafran soldiers were gripped by mass

hysteria. Biafrans abandoned the bulk of their military equipment in Onitsha.

All schools in war-torn Biafra were closed for three years and converted as military barracks and as refugee camps. One in fifteen Igbo-speaking persons died in that 30-month-long war. In **1968**, my ancestral hometown of Onitsha, **Nigeria**, was described as the bloodiest battlefield in the history of Africa.

One Day We Had to Run!

At about six o'clock in the evening of March 20, **1968,** we for the fourth time fled as refugees from Onitsha. That afternoon, the town of Abagana, which was fifteen miles away, was captured by the Nigerian Army. The Nigerians outnumbered and outgunned the Biafrans by four to one.

We fled because we saw disorganized Biafran soldiers fleeing from the Abagana War Front. Fleeing Biafran soldiers alerted us that the Nigerian Army will capture Onitsha in about six hours. Knowing that Nigerian soldiers did not take prisoners, we fled from 14 Mba Road, **Onitsha**, to The Merchants of Light School, **Oba**.

Two months earlier, on January 19, **1967**, my family fled as refugees from the battlefield at Awka, Biafra. We fled back as refugees to 14 Mba Road, Onitsha, even though we fled from

Onitsha as refugees to **Ogidi** and to **Awka** and did so three months earlier, on October 12, **1967**.

From October 4 through 12, **1967**, artillery rockets rained from the banks of the River Niger at **Asaba** to our neighborhood in **Onitsha**. Within hours, downtown Onitsha, called Odoakpu and Fegge Quarters, became a ghost town. My family fled from my father's house at 4B Egbuna-Adazie Street, Onitsha, to my maternal grandfather's house at 6C Wilkinson Road, Onitsha, and to the compound that was seven miles away at Nkwelle Ogidi, **Biafra,** where my maternal grandmother was born and fled to Awka, **Biafra**.

In February 1968, Russian MiG-17 jet fighters strafed our neighborhood of 14 Mba Road, Onitsha. Biafran anti-aircraft weapons were fired from a nearby civilian house and fired at the MiG-17 jet fighter. That Biafran anti-aircraft strike incensed the Nigerian Air Force. Nigeria reacted by sending its Russian Ilyushin IL-28 Beagle medium bombers to drop bombs upon refugees that fled from artillery shelling that originated from the west bank of the River Niger at Asaba. My family fled from downtown Onitsha to uptown Onitsha, called *Énú Ọnịcha*.

On the early morning of March 21, **1968**, I lost two cousins, 17-year-old Patrick Okwuosa and 24-year-old John **Okwuosa.** Both surrendered to Nigerian soldiers at their house at 9 Egerton Road, Onitsha, that was across the street from Zik's Institute.

On March 21, 1968, the population of **Onitsha** was about fifteen thousand refugees, or one in twelve of its original residents. Five months earlier, the population of Onitsha was 180,000. That day, two thousand male refugees were executed by the Nigerian Army. The male Igbo refugees were killed to avenge the loss of fifteen thousand Nigerian soldiers whom Biafran soldiers killed back on October 12, 1967.

Those Nigerian soldiers were trapped at the east bank of the River Niger of downtown Onitsha. And could not flee—**across** the destroyed River Niger bridge—to the west bank at Asaba. Fifteen thousand Nigerian soldiers were killed by Biafran soldiers during the ensuing house-to-house fighting that lasted a few days following October 12, 1967.

In the following five months, my family fled by foot from Onitsha to Ogidi, which was seven miles away. About three weeks later, we fled from Ogidi to Awka, where my father was reassigned as a nurse. We spent the Christmas of 1967 in Awka. On January 19, 1968, we fled from Awka and back to Onitsha. We fled a few hours before the Nigerian Army advanced from Enugu to capture Awka. Again, my father was reassigned as a nurse to Oba, Biafra.

At about six o'clock in the evening of March 20, **1968,** we fled from advancing Nigerian Army. We fled as refugees from Onitsha. And fled because we saw poorly-armed Biafran soldiers

that should be protecting us fleeing from the Abagana battlefield which was sixteen miles away.

That night, Biafran soldiers were in total disarray and outgunned and lost their will to fight. The Nigerian Army rapidly routed the Biafran Army. Biafran soldiers fled from the Abagana battlefield through Ogidi, **Nkpor**, and Onitsha. During that five month period of four Nigerian military invasions, from October 12, **1967** through March 21, **1968**, Onitsha, a renowned city of commerce, was reduced to a ghost town of about fifteen thousand refugees who were all indigenes of Onitsha.

After three military invasions of downtown **Onitsha** that each originated from Asaba and **across** the River Niger, the refugees fled from downtown Onitsha—consisting of **Fegge** and **Odoakpu** Quarters—and fled to the greater safety of the Inland Town part of Onitsha.

When the Nigerian Civil War ended on January 15, 1970, one in fifteen Biafrans had died. And my hometown of Onitsha was declared as the bloodiest battlefield in African history.

FROM BIAFRA TO USA

In June 1970, at age fifteen and in Onitsha, I had an epiphany. Because I was considered gifted in mathematics, the possibility of me getting a scholarship to the USA wasn't far-fetched. So, I began nursing the idea
of coming to the USA.

Three years later, I won a scholarship to Oregon, USA, that was dated September 10, 1973. Nine months later, I was in Corvallis, Oregon, programming one of the world's fastest supercomputers. I used the technology to solve a system of equations of algebra.

Obstacles in Inventing the Fastest Computer

Why Are Supercomputers Used in Nigeria?

A Nigerian writing a school essay asked me: "Why are supercomputers used in Nigeria?" The energy and geoscience industries bought one in ten supercomputers, and use them to pinpoint deposits of crude oil and natural gas.

There are 65,000 oil and gas fields around the world. My country of birth, **Nigeria**, has 159 oil and gas fields. The Bonga Oil Field of **Nigeria** was discovered in **1996.** That oil field was at

an average depth of 3,300 feet. The estimated oil in the Bonga Oil Field is about 1.5 billion barrels.

The fastest computing executed **across** millions of processors must be harnessed and used to recover about half of the oil discovered in the Bonga Oil Field. In 1989, I was in the news for discovering how the slowest processors in the world could be harnessed as the world's fastest computer and **across** an Internet that's a global network of those processors. And used to discover and recover otherwise elusive crude oil and natural gas.

Why I Began Supercomputing in 1974

I began supercomputing, on Thursday June 20, **1974**, when **President Richard Nixon** was in The White House. I began scalar supercomputing by writing my first supercomputer code in my one-room studio apartment that was upstairs of a **white house** at 195A Knox Street South, Monmouth, Oregon, USA. I began fastest computing when it was a **crime** to sell a supercomputer to the Soviet Union who might use that supercomputer to simulate **nuclear explosions**. Not only that, I began supercomputing sixteen months after the last man returned **from the Moon**. I began supercomputing on a machinery that was ranked as the **world's fastest computer** eight years earlier,

or in December 1965. Back then, I used supercomputers to solve mathematical equations.

Since the 1930s, algebraic equations were the most recurring decimals in computational physics. So, it should not come as a surprise that the Computer Center, that I used in 1974, was between the physics building and mathematics building that was named Kidder Hall. Kidder Hall is a large neoclassical building that encompassed a full basement and three stories. In Oregon, Kidder Hall is the center of mathematical research. I left Kidder Hall on June 5, 1977.

For me, the next fifteen years of living and working in the District of Columbia, Maryland, Wyoming, Michigan, and Minnesota were full of **obstacles,** both scientific and racial.

Overcoming Obstacles in Supercomputing

In my first two decades in the USA, I learned and discovered how to harness the slowest processors in the world. And use them to power the fastest computers in the world. But there were times in the 1970s and 80s that I felt **frustrated**. **I felt frustrated** because I was a Black supercomputer geek that was ostracized. Furthermore, **I felt frustrated** because I was forced to conduct my supercomputer research unfunded and alone. **I felt frustrated** by the challenges of being a supercomputer scientist who was the lone wolf at the **farthest frontier** of mathematics

and physics. **I felt frustrated** because I was the lone programmer of my experimental ensemble of 65,536 processors. Not only that, **I felt frustrated** because my Holy Grail was to emulate a supercomputer. And do so by supercomputing **across** the slowest sixty-four binary thousand processors in the world.

In the 1970s and 80s, there were times I felt that the technology of computing across processors will never power the supercomputer of the future. Sometimes, I felt that the fastest computing **across** up to a billion processors will forever remain impossible to harness. And used to forecast the weather. In the early 1980s, I felt like I wasn't discovering much about the fastest computing **across** the slowest processors.

Diary of a Black Supercomputer Scientist

As a Black African supercomputer scientist who worked as an outsider in white American supercomputer centers, my research in fastest computing was and had to be **subterranean**. In the early 1980s, I was called a lunatic, humiliated, and dismissed by my research teams who believed that the fastest computing across the slowest processors will forever remain a huge waste of everybody's time. In the 1980s, my mathematical theories about fastest computing and how to solve the hardest problems in parallel, or solve sixty-four binary thousand

mathematics problems **at once** were ridiculed and dismissed as **unworkable** and **unrealistic**.

I discovered that to overcome racism in U.S. supercomputer laboratories demands my **anonymity** without my being invisible. Until **1989**, the supercomputer scientists that I corresponded with, earlier in the **1970s** and **80s** didn't know that I—**Philip Emeagwali**—was a Black, sub-Saharan African. Ironically, being a Black supercomputer scientist put me at an advantage. It enabled me to discover that the world's slowest processors could be harnessed and used to power the world's fastest computers.

If I was a white supercomputer scientist, I would have been given more significant opportunities and privileges. I would have been accepted and absorbed into a large multidisciplinary research team of supercomputer scientists, such as Cray, Intel, or IBM. I would have accomplished more with less supercomputing knowledge. Being Black and African forced me to conduct my multidisciplinary supercomputer research alone. And to be a mathematician who's a polymath and shared his multidisciplinary knowledge across one thousand podcasts and YouTube videos.

That mastery enabled me to harness the total and maximum supercomputer power of my coupled ensemble of the two-**raised**-to-power sixteen slowest processors in the world that were designed for a mainstream market, rather than for

supercomputing. And manufactured in colossal numbers and for a lower price.

As a polymath, I understood extreme-scale mathematical and computational physics, differently. And I understood it in a broader sense than a mathematician, or a physicist, could understand it. That’s the reason I could post one thousand closed-captioned videos on YouTube that each explained my contributions to mathematics, physics, and computer science. **Seymour Cray**, who designed seven in ten supercomputers of the 1980s, posted about ten original videos on YouTube. **Albert Einstein**, the father of modern physics, has fewer than ten original videos on YouTube.

Philip Emeagwali's whiteboard from a lecture on his world's fastest computing of July 4, 1989.

FASTEST COMPUTING IS MY CONTRIBUTION TO PHYSICS

How I Pushed the Boundaries of Physics

When Textbook Theory Contradicted My Experiment

Students writing a short essay on famous scientists are often asked: “What are the contributions of Philip Emeagwali to physics?”

As a physicist who came of age in the 1970s, I contributed to geophysical fluid dynamics, and in particular, to hydrodynamics, the branch of physics that affects your everyday life the most. **Hydrodynamics** is the subject that Leonardo da Vinci investigated the most. I understood **computational hydrodynamics** both physically and **across** processors.

I began as a theorist. A theory is an idea that’s not positively true. A theory is not a fact. According to an earlier fluid dynamics theory, the weight and shape of the bumble bee and their relations to the wingspan of the bumble bee should make it impossible for the bumble bee to fly. However, the bumble bee is not a mathematician nor does it not understand the laws of physics and, therefore, in its ignorance it defies our physics theories and did so by flying.

Often, the facts prove our theories to be wrong. It's a fact that my world's fastest computing was recorded **across** a new Internet that was a new global network of the slowest processors in the world. It made the news headlines when I made that fastest computing discovery, back on the Fourth of July **1989**. My discovery of the fastest computing across the slowest processors proved earlier textbook theories wrong.

How is Computational Hydrodynamics Used?

In **1986** and **87**, I was an engineering physicist who helped operate nine **hydroelectric** dams. Those nine dams were built by the U.S. Bureau of Reclamation that was the number-one dam builder in the world. As an engineering physicist employed by the U.S. government, I possessed the hydrological knowledge that must be used to protect the residents who lived on the flood plains of the 716-mile-long North Platte River. That river flows through **Colorado**, Wyoming, and **Nebraska**. And has a discharge of 1,355 cubic feet per second.

The nine North Platte River dams, within Wyoming, that I operated were small compared to the Kainji Dam of the 4,180-kilometer-long River Niger. The Niger has a discharge of 197,400 cubic feet per second.

In the late **1970s**, I researched how to use **computational hydrodynamics** and use it to forecast the motion of flood waves that will arise if the spillway of a dam breaches, or if a dam breaks. Such mathematical calculations—from solving an initial-boundary value problem of computational hydrodynamics—must produce the flood-inundation maps for the North Platte River flood plains.

As an engineering physicist, I explained the standard operating procedures to dam tenders. I instructed dam tenders on when to lower water levels along the North Platte River of Wyoming. Unlike other supercomputer scientists who were trained only in computer architecture, I knew hydrodynamics from both the fluid dynamics textbooks and field experiences that I gained along the reservoirs of the nine dams of the North Platte River.

Back in 1969, I knew hydrodynamics from swimming far downstream of the Kainji Dam that holds a reservoir of 500 square miles of water. And holds it upstream of the River Niger at Ndoni (Biafra, **Nigeria**). The River Niger, called *Orimili*, is the principal river of West Africa. *Orimili*, the Igbo translation to the "great water," is 2,600 miles long. It's the third-longest river in Africa.

My **multi**disciplinary experiences range from **1969** at the Biafran Navy marine base that was at the Oguta War Front on the

east bank of Oguta Lake to the frontier of supercomputing that was in Silicon Valley in **1989.** Those were the experiences that enabled me to conduct my supercomputing research and do so as a lone wolf.

My Retrospective on Fluid Dynamics

To conduct research alone and to simultaneously do so at the **frontier** of physics, at the **frontier** of mathematics, and at the **frontier** of computer science is the definition of a polymath. And a true supercomputer scientist.

Looking back retrospectively, computational fluid dynamics has a two-and-a-half century history. The two centuries between **1740** and **1940** were the era of analytic fluid dynamics. During that era, partial **differential** equations that govern the motions of fluids—such as **Euler's equations—**only lived in obscure academic journal papers. Or on the mathematician's blackboard. Such equations were never discretized and coded for the motherboard. Or for the evening weather forecaster.

Unleashing the Power of Parallel Computing as the New Mathematics

For the fifteen years following June 20, 1974, at 1800 SW Campus Way, Corvallis, Oregon, USA, I grew from being one of

the time-sharing programmers of one of the world's fastest computer that was powered by only one central processing unit to prevailing as the only full-time programmer of sixteen of the world's state-of-the-art supercomputers that was each powered by up to sixty-four binary thousand central processing units.

I theorized the world's fastest computer as powered by an Internet that is a global network of up to one billion processors. That was how I was a "discovered" as the only father of the Internet that invented an internet, back in **1974**.

Mathematics is taught to every student. It's a mandatory subject during the first twelve years of schooling. But the mathematics learned in school was developed one to five thousand years ago. The world's fastest computing, as it's known today and as it's expected to be known tomorrow, is a new mathematical knowledge that came of age on July 4, 1989, the date I discovered it.

Parallel supercomputing is my contribution to mathematics. Supercomputing is the invention and milestone that changed the way the modern mathematician solves his or her most compute-intensive problems.

UNLOCKING THE POSSIBILITIES OF PHYSICS

In school essays, an often-asked question is this: “What are the contributions of Philip Emeagwali to physics?” Please allow me to quote myself from a lecture that I gave to research physicists, back in the early 1980s.

“The governing partial **differential** equations of gas dynamics were invented from the laws of conservation of mass, momentum, and energy. The number of partial **differential** equations is less than the number of dependent variables in the equations.

To complete the system of equations demanded we introduce an equation of state. Like the ideal gas law that introduces temperature as a new dependent variable. Doing so, requires we introduce another equation of state.

Substantial progress in developing partial **differential** equations was made during the hotbed of research activities that occurred during the 75 years that were inclusive of 1840 through 1915. That was the period the Navier-Stokes equations and analogous partial **differential** equations that govern the motions of fluids were formulated. During those seventy-five years, the

practicing engineer only used algebraic and differential equations for his fluid dynamics calculations.

An often used equation was the **Bernoulli equation** that's a nonlinear differential equation of the first order. During those years, the abstract governing partial **differential** equations of analytical fluid dynamics remained as textbook abstractions."

My Retrospective on Computational Physics

Without the programmable computer that came into existence from 1946 onward, there will be no computational fluid dynamics, and no weather forecasts. And the analytical fluid dynamics of the pre-computer era will remain in the realm of pure mathematics that remains of interest only to mathematicians and physicists that were within academia.

Retrospectively, we had two hundred years—from **1740** to **1940**—of analytical fluid dynamics. The experimental fluid dynamics that was extensively investigated by **Leonardo da Vinci** in the late 15th century, was followed by the analytical fluid dynamics of 1740 through 1940. And then followed by the computational fluid dynamics of the 1950s, 60s, and 70s.

And, finally, followed by the extreme-scaled massively *parallel-processed* fluid dynamics that was in the news because I discovered it when I executed it **across** an ensemble of 65,536

coupled processors, back on July 4, 1989, in Los Alamos, New Mexico, USA.

The Nine Philip Emeagwali Equations

Because this system of partial **differential** equations was beyond the frontier of calculus and encoded the Second Law of Motion of physics, it's used to predict the flows of crude oil, natural gas, and injected water flowing **across** a highly anisotropic and heterogeneous producing oil field. The system of coupled and nonlinear partial **differential** equations which governs an initial-boundary value problem at the frontier of calculus and computational fluid dynamics that represents the Earth is the tool used to predict the long-term planetary motions of air and water. Such planetary motions are the essences of climate models. We can predict atmospheric and oceanic motions and do so with the accuracy the Second Law of Motion is used to predict the future positions of the Moon and Sun.

The nine Philip **Emeagwali** equations are as reliable as a hammer. My contribution to mathematics **is this**: I extended the borders of mathematical knowledge by a distance of thirty-six partial derivatives of calculus. The partial derivatives of calculus measure changes in properties, such as velocities, pressure, and friction. The computed solutions to a system of nonlinear partial

differential equations that governs an initial-boundary value problem, called petroleum reservoir simulation, correspond to the flow of crude oil, natural gas, and injected water that flow up to 7.7 miles (or 12.4 kilometers) deep. The depth of an oil well is up to eight times the length of the Second Niger Bridge of Nigeria. An oil field is about the size of my hometown, Onitsha, **Nigeria**.

How Did Philip Emeagwali Impact Mathematics?

A question in school essays on famous mathematicians and their contributions to mathematics **is this**: "What are the uses of the Philip Emeagwali equations?"

Each time you ride in a car you did so because the new knowledge that I discovered on the Fourth of July 1989 was used to pinpoint the locations of crude oil and natural gas. I was the first person to discover how the petroleum industry could use millions of processors to solve a system of trillions of equations of algebra. Such algebraic equations arise during the computations of the miles-deep subterranean flows of crude oil and natural gas.

Such large-scale algebraic problems can only be solved **across** the millions of processors that power the world's most powerful supercomputers. State-of-the-art supercomputers are

used to discover and recover crude oil and natural gas that were buried up to 7.7 miles (or 12.4 kilometers) deep. Without the supercomputer, such crude oil and natural gas would remain undiscoverable and unrecoverable.

As an analogy, the supercomputer is to the geologist or meteorologist or physicist or mathematician what the telescope is to the astronomer. Just as the world's biggest telescopes are used to locate distant stars, the world's fastest computers must be used to pinpoint the locations of crude oil and natural gas that are deposited up to 7.7 miles deep.

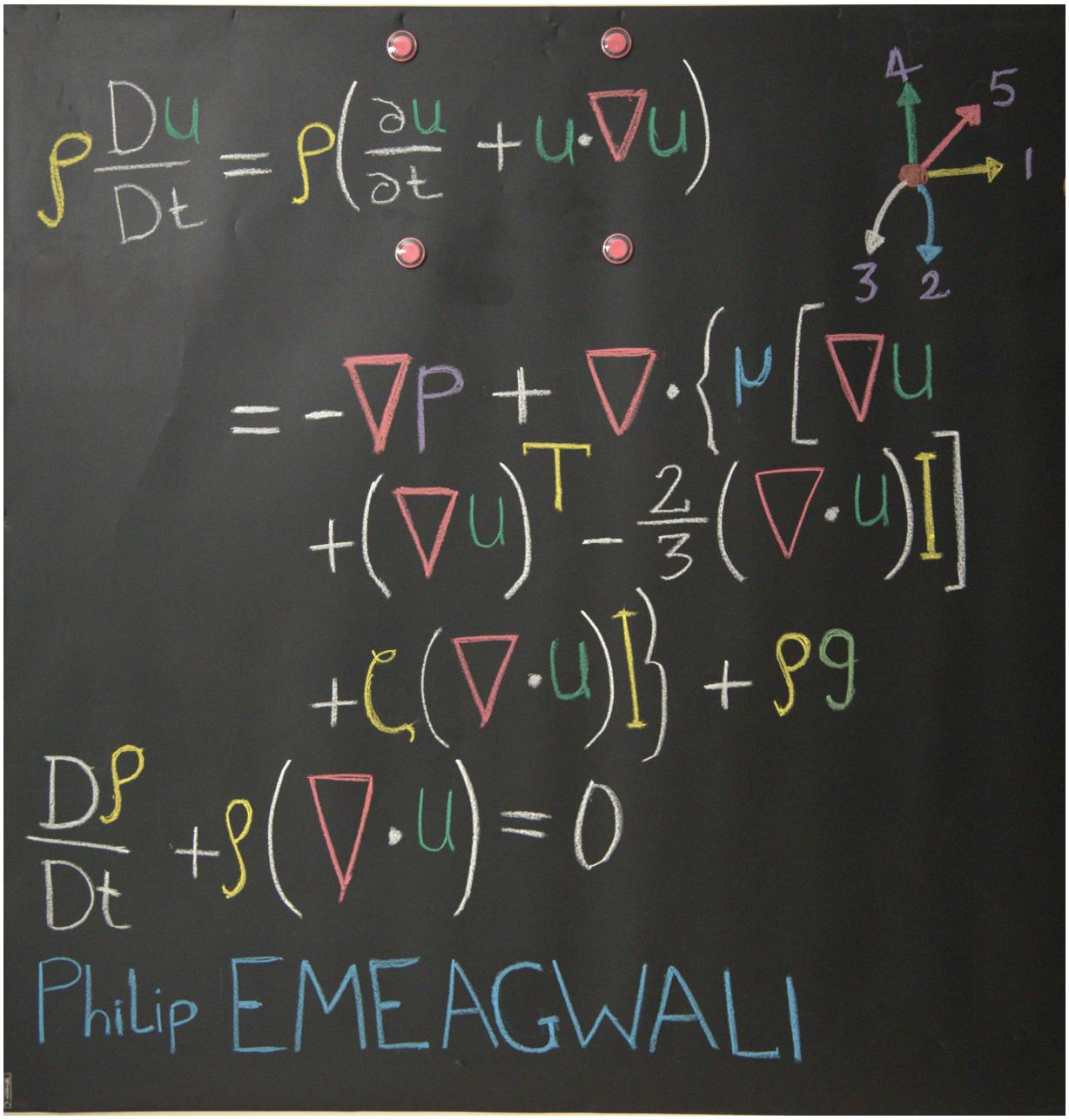
I used the word "**algebra**" a thousand times in the one thousand lectures that I posted as podcasts and on YouTube. The reason was that I discovered how to solve a system of equations of linear algebra. I also discovered how to solve those equations **across** a new global network of up to one billion processors. I visualized my network as my new Internet.

When Fiction Becomes Science

When I was coming of age as a supercomputer scientist and in the 1970s and 80s, the first world's fastest computing across the world's slowest processors was an unconfirmed theory. Before my discovery of the world's fastest computing, which occurred on July 4, 1989, how to solve the most compute-

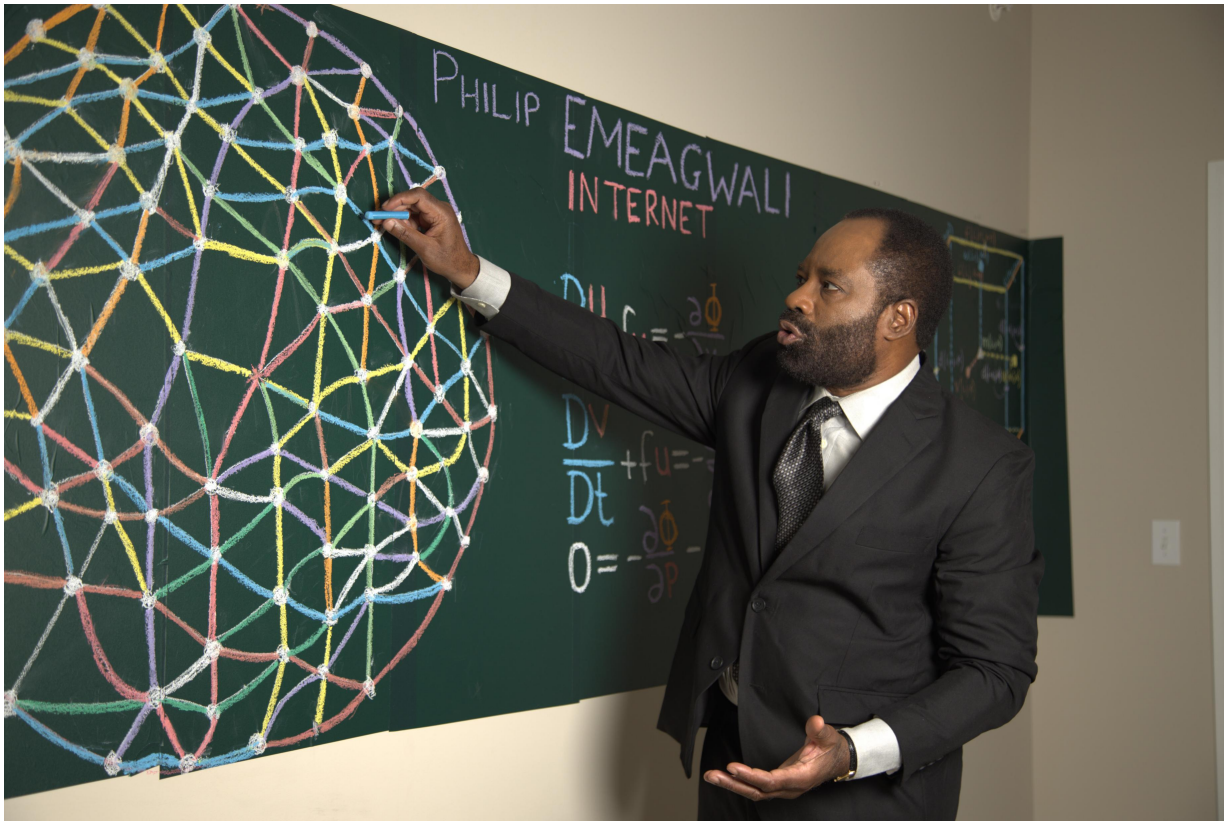
intensive problems wasn’t known, wasn’t taught, and wasn’t in any mathematics or physics or computer science textbook and examination.

Before my discovery, the fastest computing **across** the slowest processors only existed in the realm of science fiction. Making that science fiction to become nonfiction felt like a benediction when I and my discovery were validated, in 1989, with the highest award in supercomputing. It made the news headlines because I was unknown and won that award alone.



The equations behind fluid dynamics.

2ND LECTURE: A NEW WAY OF SEEING EMEAGWALI INTERNET



Philip Emeagwali: **"I am the only father of the Internet that invented an Internet."**

Broadcast 2 October 2021

https://youtu.be/pzbNasO1sFk

FASTEST COMPUTING FROM SLOWEST PROCESSORS

Unlocking the Limitless Possibilities of the World's Fastest Computer

My quest for the world’s fastest computer began on June 20, 1974, on a scalar supercomputer at 1800 SW Campus Way, Corvallis, Oregon, USA. My quest was to be the first person to fully understand how an ensemble of up to a billion processors can work together to solve the most compute-intensive problems and thus make the computer super. That quest began on the central processing unit of a supercomputer that was ranked as the world’s fastest computer, seven years earlier.

My search was for the fastest computation of an initial-boundary value problem that was beyond the frontier of calculus and fluid dynamics. The perennial list of the most compute-intensive problems includes climate modeling across millions of processors. High-stake climate models are governed by a system of coupled, nonlinear, three-dimensional, and time-dependent PDEs, or partial differential equations, or rather, governed by discrete approximations of those PDEs that were used to translate the continuous problem from calculus to its discrete analog in large-scale computational linear algebra.

My search for the most massively parallel-processed solutions of the most compute-intensive problems in mathematical physics was my search for the answer to the most recurring question in supercomputing. That unanswered question was classified by the U.S. government as a Grand Challenge Problem of supercomputing at the crossroad where the frontiers of knowledge in mathematics, physics, and fastest computing intersect.

My discovery that the world's fastest computing can be executed across the world's slowest processors occurred at fifteen minutes after 8 o'clock in the morning of July 4, 1989, in Los Alamos, New Mexico, USA. Before my supercomputing discovery, no mathematician or physicist or computer scientist could answer that big question.

Leapfrogging from Slowest Processing to Fastest Computing

The story of how the fastest computer was invented from harnessing the slowest processors was incomplete. That story remains incomplete because a new answer brings forth a new question. My answer to how to solve the most compute-intensive problems and solve them by supercomputing **across** the slowest processors brings forth the new question of how to solve the

same initial-boundary value problems—such as large-scale computational fluid dynamics—and solve them fastest on a quantum computer.

The Nine Philip Emeagwali Equations

Students are asked to write a short essay on the nine **Philip Emeagwali** equations. This essay question will not be dated in five thousand years. Technology does not age well. The vector supercomputers, of the 1970s and 80s, were replaced by the world's fastest computers of today.

Science ages well. Mathematics ages well. **Pythagoras** theorem predates Pythagoras by one thousand years. **Pythagoras** theorem was known during the reign of Hammurabi the Great. Therefore, the **nine Philip Emeagwali equations** will not become obsolete, just like **Pythagoras** theorem, that has been known for four thousand years, didn't become obsolete.

I write equations, algorithms, and programs, daily. I write equations the way poets write poems. A supercomputer scientist proves he understands the partial **differential** equation that is beyond the frontier of calculus, or mathematics and physics textbooks, and does so if and only if, he can explain his equation on YouTube. And if and only if he can code the solution of an initial-boundary value problem that was governed by his partial

differential equation. And if and only if he can email the initial and intermediate boundary conditions and email them to and from the millions of processors that **outline** and **define** his or her massively parallel supercomputer.

I visualized my new supercomputer as a new Internet that's my new global network of processors that's not a computer, by its very nature. It's a new Internet, in reality. I'm the only father of the Internet that invented an Internet.

Why I Invented the Nine Philip Emeagwali Equations

Fast-forward eight years after June 20, 1974, in Corvallis, Oregon, USA. I was in the nation's capital of Washington, D.C. During the first half of the 1980s, I lived and conducted supercomputing research in the three Maryland cities of Baltimore, Silver Spring, and College Park.

During the two decades that followed 1970, I grew in my knowledge of mathematics, physics, and computer science. By the late 1980s, I was standing alone at the frontier of knowledge of how to manufacture computers that are powered by a billion processors. And that can compute a billion times faster.

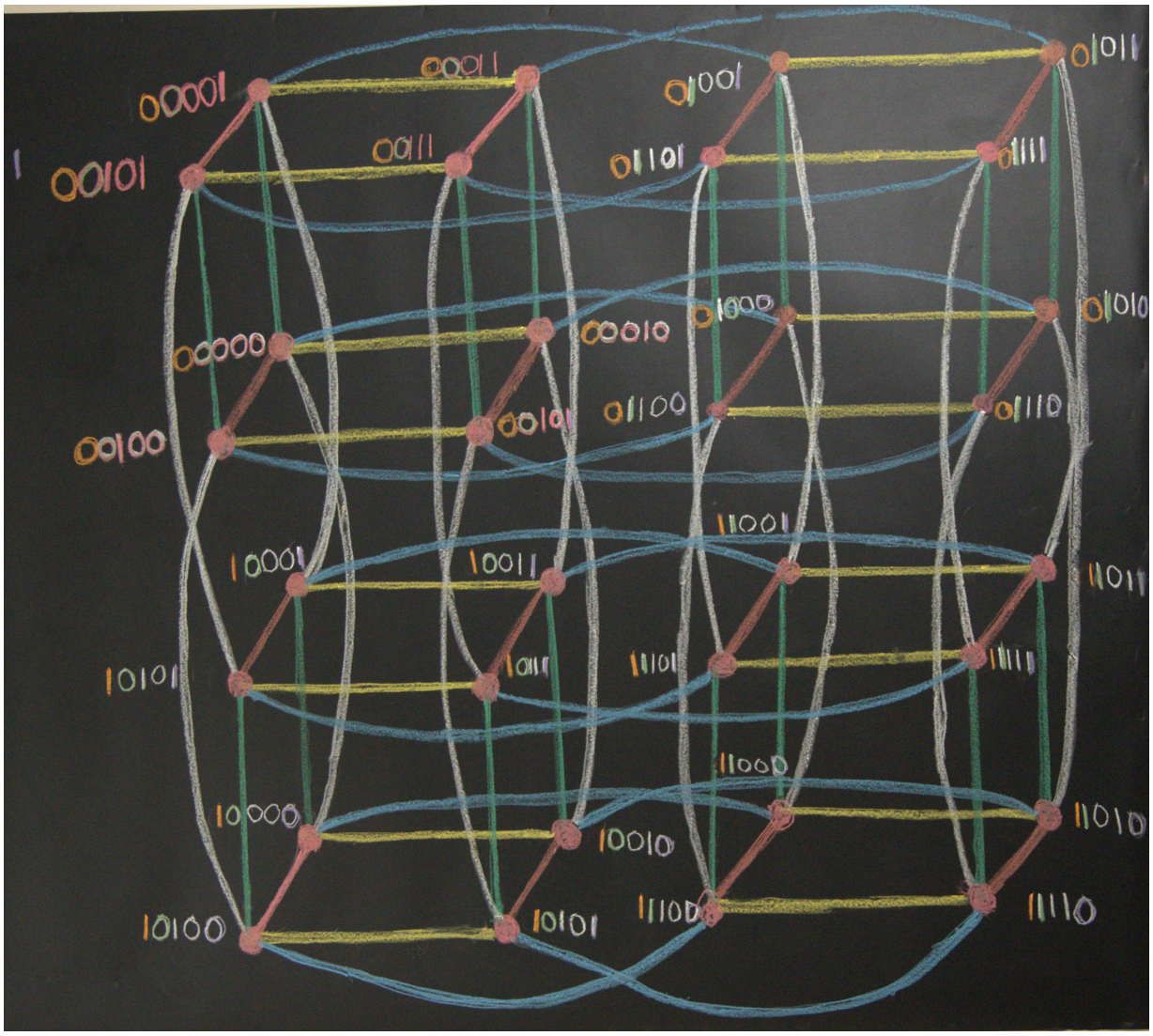
That was the reason I received invitations to give lectures on my theoretical discovery of how I'll massively parallel process. And solve the most compute-intensive mathematical

problems in meteorology and geology. And solve them **across** millions of off-the-shelf processors that shared nothing.

I discovered how to solve the most compute-intensive problems in extreme-scale computational fluid dynamics, such as modeling hurricanes and tornadoes. And doing so to protect life and property. And designing hypersonic aircraft, quiet submarines, and efficient automobile bodies. But in the early 1980s, my supercomputing lectures were dry and abstract.

In the 1980s, my reformulations, discretizations, and stability analyses of my new system of partial **differential** equations were impenetrable to the layperson. In the 1980s, my world's fastest computing quest was to translate the **nine Philip Emeagwali equations** which I invented on the blackboard. And code their discretized, algebraic approximations on a never-before-seen motherboard.

My new motherboard was a new Internet that was a new global network of 65,536 coupled, off-the-shelf processors. I visualized those processors as identical and as uniformly and tightly encircling a globe. And I visualized my globe as embedded within my sixteen-dimensional hyperspace. Furthermore, I visualized those two-**raised**-to-power sixteen processors as **defining** and **outlining** a new Internet. And doing so just as computers encircle the Earth and **define** and **outline** the Internet.



Philip Emeagwali's visualization of the five-dimensional subset of his 16-dimensional supercomputer network.

Unlike other research computational mathematicians, of the 1970s and 80s, I believed that my mathematical script should be heard on the stage (or on the motherboard) rather than read on the page (or on the blackboard). The computer is to the partial **differential** equation what the microphone is to the poem.

I was not an overnight success. I've been supercomputing for the fifty years onward of June 20, 1974, in Corvallis, Oregon, USA. The chicken does not lay its egg and hatch it the next day. I progressed from the analytical fluid dynamics of the 1970s to the large-scale computational fluid dynamics of the 1980s. In 1974, in Corvallis, Oregon, USA, I wrote supercomputer codes for one processor. And for solving a huge system of equations of algebra. Over the two decades, from 1970 to 1990, I grew in my scientific knowledge and mathematical maturity. I grew from merely knowing the Second Law of Motion described in physics textbooks.

That law was discovered, in prose, three centuries and three decades ago. I grew from knowing that law only in prose and algebra to encoding that law into the nine partial **differential** equations called the Philip **Emeagwali equations.** My equations govern the three-phased flows of crude oil, injected water, and natural gas that flow along three dimensions and **across** porous media that're both heterogeneous and anisotropic.

I developed the mathematical maturity and the knowledge that I used, in the early 1980s, to discretize and analyze the consistency, stability, convergence, and the error propagation rates of my new finite difference discretizations of the linearized nine Philip **Emeagwali equations**.

I think of myself as a mathematician, first. The twelve-year-old writing an essay on famous inventors think of me as a computer scientist, first. But some old friends remember me as a physicist or an engineer. What's the difference between scientific research and engineering practice? To discover is to make the unknown know. For that reason, the research scientist should not know what he's doing. But the Chief Engineer for the mile-long Second Niger Bridge in Nigeria must know what he's doing.

Why should someone, like myself, spend fifty years learning what is already known and trying to make the unknown known? That's like asking: Why should a six-year-old learn how to add and subtract, which is already known? The up-and-coming supercomputer scientist must have her eyes fixed on how to scale new summits, such as solve the most difficult problems in science, engineering, and medicine. And solve them on a quantum computer.

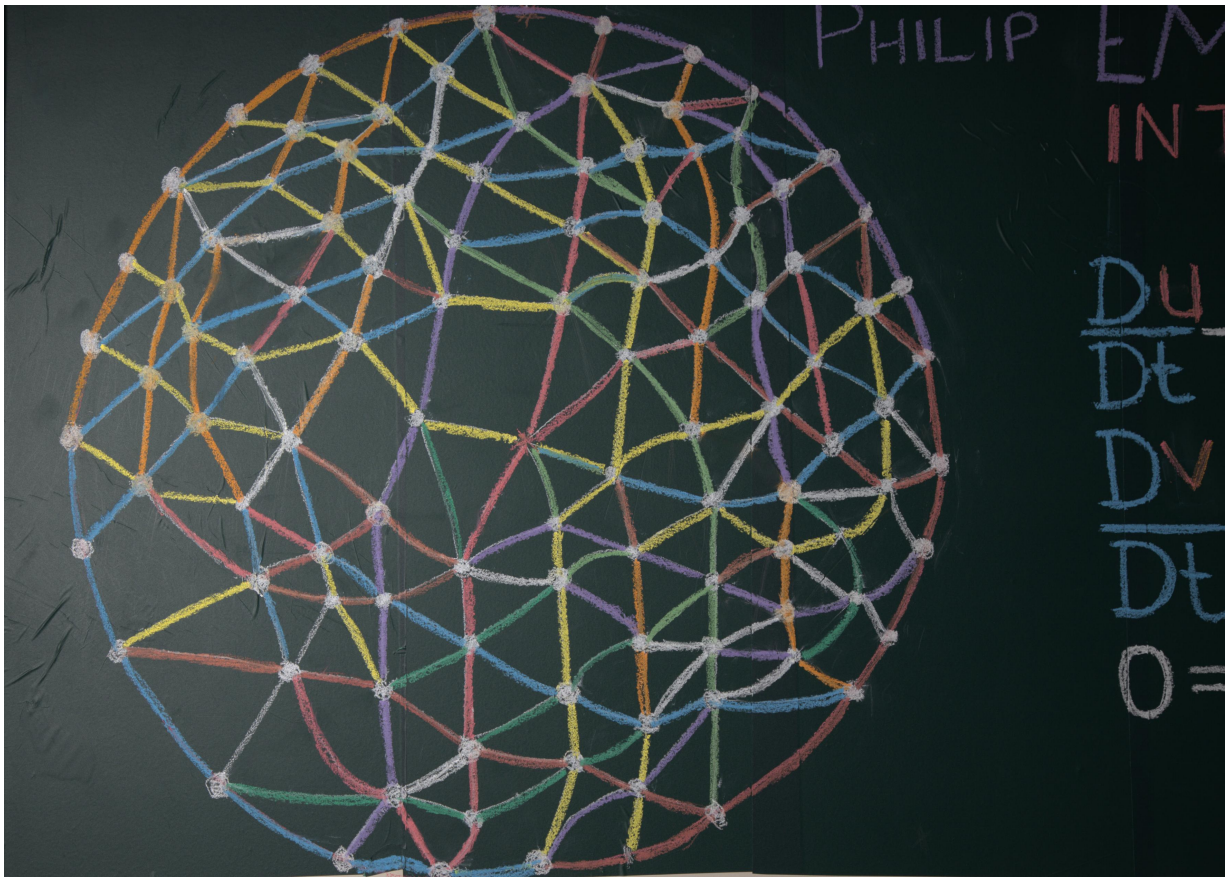
PHILIP EMEAGWALI

INTERNET

My Eureka Moment

The Eureka moment, or high point, of my quest for the fastest computer in the world occurred on July 4, 1989, in Los Alamos, New Mexico, USA. And it occurred across my ensemble of the slowest 65,536 processors in the world.

I invented a new Internet that consisted of sixty-four binary thousand processors (or, equivalently, 65,536 computers) that were uniformly distributed **across** the surface of a globe. That new global network of 65,536 processors was my small copy of the Internet that's a global network of computers. My new global network of up to a billion processors that uniformly encircled a globe, in any dimension, is called the Philip Emeagwali **Internet**.



Philip Emeagwali's back-of-the-envelope sketch of the blueprint for his supercomputer that's also an Internet.

Supercomputing Compute-Intensive Problems

In 1989, my sixty-four binary thousand processors communicated via emails that contained 65,536 fluid dynamics codes that I sent from up to sixteen nearest-neighboring processors. My computer codes and email primitives were esoteric and weren't meant to be read by humans.

I was computing at the world's fastest speeds back from June 20, 1974, in Corvallis, Oregon, USA, to July 4, 1989, in Los Alamos, New Mexico, USA. In that decade and half, I observed

that nine out of ten supercomputer cycles were executed by large-scale computational physicists who used the supercomputer to execute their computational fluid dynamics codes. And do so for the greatest accuracy and the highest model resolution.

In the 1970s and 80s, the poster boy of extreme-scale computational fluid dynamics codes was the global climate model that must be used to foresee otherwise unforeseeable centuries-long global warming. In those two decades, short-term weather forecasts and long-term climate studies consumed five percent of all supercomputer cycles.

The poster girl of computational fluid dynamics supercomputer codes was the petroleum reservoir simulation that must be used to hindcast, or re-forecast, how to recover otherwise unrecoverable crude oil and natural gas that are often buried up to 7.7 miles (or 12.4 kilometers) deep. And buried **across** an oil producing field that's about the size of Johannesburg (**South Africa**). Petroleum reservoir simulation, alone, consumed ten percent of all supercomputer cycles.

Where Are the Fastest Computers?

I began programming the fastest computers, on June 20, 1974, in Corvallis, Oregon, USA. Back then, my theory of fastest computing **across** a billion processors was in the realm of

science fiction and not in science textbooks. And solving the most compute-intensive problems by dividing-and-conquering them **across** a billion processors was an unexplored field of knowledge that wasn't then on the map of computer science.

In 1974, my theory of the fastest computing **across** the slowest processors evoked laughter. Back then, the supercomputer of today that's powered by millions of processors only existed as a science-fiction technology that had no programmer or prophet. In the 1970s, the vector supercomputer was the accepted technology for all supercomputing. Back then, vector processing had twenty-five thousand evangelists.

The two titans of the supercomputer world were **Gene Amdahl** of Amdahl's Law fame and **Seymour Cray** the pioneer of vector supercomputers. In the 1970s and 80s, the most **revered prophet** of vector supercomputers was **Seymour Cray,** the founder of Cray Corporation, the company that manufactured seven in ten vector supercomputers.

In the 1960s and 70s, the most revered prophet of scalar supercomputers was **Gene Amdahl** of **Amdahl's Law** fame. **Gene Amdahl** was the supercomputer manager at International Business Machines (IBM) Corporation, the company that now manufactures the most supercomputers sold in the USA.

Black in All-White Supercomputing Community

As a Black sub-Saharan African mathematician who came of age in the 1970s Oregon and negatively typecast in the mid-1980s Michigan, I gained credibility as a "genius" because I presented a never-before-seen supercomputer. And presented the technology in both prose and poetry and straight from the heart.

Unlike the academic mathematician, I did not read the nine **Philip Emeagwali** equations and their nine companion **Philip Emeagwali** algorithms and did not copy them from any textbook. The Black mathematician is judged by a higher standard. That meant that I had to develop ways for solving the most difficult problems at the intersection where new physics, new mathematics, and new computing intersected.

I did not solve the Grand Challenge Problem on the blackboard, alone. I solved it **across** a new Internet that's a new global network of millions of coupled processors. For that contribution to science, I won the highest award in supercomputing. Computer scientists refer to my award as the Nobel Prize of Supercomputing.

I stood out because I was a Black mathematician and a supercomputer scientist who computed alone. Furthermore, I came of age in the 1970s and 80s and within a nearly all-white male supercomputing community. As a young Black and African supercomputer scientist, I was compelled to conduct my physics and mathematics research alone.

My approach differed from working within a multidisciplinary team of one thousand specialists. I had to do my research as an outsider to all the companies like Cray, Intel, or IBM (or International Business Machines) corporations. I was unknown for the fifteen years that followed June 20, 1974, the day I first programmed one of the world's fastest computers. During those fifteen years, I grew in my mathematical and scientific maturity.

And I programmed thousands of processors that I visualized as encircling a globe and doing so in the manner the Internet now encircles the Earth. I was the first person to parallel process computational fluid dynamics codes at world record speeds. And solve them ac**ross** a new Internet that's a new global network of off-the-shelf processors.

My contribution to technology was not a minor increase in the speed of the computer. My world record speed made the news headlines because solving the most compute-intensive problems **across** millions of processors was a radical change in the way we do mathematics. And look at the world's fastest computer in a new way.

During my first fifteen years of supercomputing, I grew in my scientific knowledge and mathematical maturity. I theorized new knowledge that could make the computer faster when powered by the slowest processors in the world. I theorized that

the then unproved technology of parallel supercomputing could be used to solve 65,536 computational fluid dynamics codes. And solve them all at once. And communicate them **across** 65,536 coupled processors.

In the 1970s, I theorized the fastest computing **across** the slowest processors. In the 1980s, I experimented with parallel processing **across** the slowest 65,536 processors in the world. The reason I experimented alone, with the slowest processors, was that the luminaries in the world of supercomputing joked that fastest computing by slowest processing will forever remain a beautiful theory that will always lack an experimental confirmation.

Philip Emeagwali Lectures

In 21st century science, the highest awards are supported with YouTube lectures. I've posted one thousand podcasts and closed-captioned videos on YouTube that each described my contributions to physics, mathematics, and computer science. The award lecture is to the historian of science what the SAT (or Scholastic Aptitude Test) is to the American university admission officer. Or what the LSAT (or Law School Admissions Test) is to the American Law School admission officer. Or what the JAMB (or Joint Admissions Matriculation Board) is to the Nigerian university admission officer.

A perfect score in the SAT, LSAT, or JAMB tests does not make a candidate the smartest person in the world. In the U.S. alone, about thirty-five thousand living Americans achieved a perfect score in their SATs. The highest awards in the fields of mathematics, physics, and computer science are given based on the discoveries and inventions contributed by the recipients and documented on YouTube.

In 1989, my contribution of the world's fastest computing made the news headlines. And earned me an award that computer scientists refer to as the Nobel Prize of Supercomputing.

Once in a century, an invention changed the definition of computer science. A radical shift in the way we solve the most compute-intensive problems is a contribution that extended the frontiers of mathematical knowledge. And resulted in revising mathematics textbooks. The lectures of well-known scientists of modern times, such as **Albert Einstein**, who is considered the father of modern physics are posted on YouTube.

I followed that scientific tradition by posting on YouTube one thousand closed-captioned podcasts and videos. Each podcast or video that I posted on YouTube described my contributions to physics, mathematics, and computer science. My video series on my inventions is the largest set of transcribed lectures ever posted on YouTube by a single inventor. Yet, I feel like I have ten thousand unrecorded videos inside me.

INVENTING A NEW COMPUTER SCIENCE

Parallel computing is the technological knowledge that enabled the computer that's powered by one thousand processors to be faster. And enabled the world's fastest computers that're powered by one billion processors to be fastest.

Once upon a time, before 1989 to be exact, the complete knowledge of the fastest computing across the slowest processors wasn't in supercomputer textbooks. During that era of darkness, the world's fastest computer, as it's known today, existed only in the realm of science fiction. I invented the first supercomputing across the world's slowest computers. And discovered it on July 4, 1989. That is, the computer scientist learned modern supercomputing because and after I invented it. And the computer instructor is teaching the world's fastest computing that I invented. The science teacher renounced his voice to give voice to the discoverer.

The computer architect or physicist or mathematician knows the world's fastest computing only after it was discovered and entered into textbooks. At its granite core, fastest computing is the knowledge of how to solve a billion mathematical

problems at once. In the past, supercomputing was solving only one difficult mathematical problem at a time.

The difference between the **author** and the **inventor** is this: The author of a science textbook is like the ghost writer who authored the story he didn't live. Or like the fifth-grader who wrote a book report on a book he didn't read. I'm **fastidious** in describing and videotaping my contributions to mathematics, my discoveries in physics,
and my inventions in computer science. I do so as a **preemptive** measure against those that want to occupy my stage and tell my story.

Einstein Versus Emeagwali

In a 60-year retrospective, I realized that I spent the first half of my life wishing I was the **Albert Einstein** that theorized **relativistic** motions of distant planets. And then spent the second half of my life wishing I was my younger self who discovered how to compute at the fastest speeds the motions of planetary fluids. To benefit posterity, I posted one thousand videotaped lectures in which I explained my discoveries and inventions. At its essence, my 1,000-part videotaped lecture series was an attempt by the old **Philip Emeagwali** to record the story of the young **Philip Emeagwali**. The knowledge possessed by a

theoretical physicist, such as **Albert Einstein**, or a computational physicist, such as **Philip Emeagwali,** can only be evaluated and compared from watching their videotaped lecture series on their discoveries in physics. The one thousand podcasts and videos of myself as the extreme-scale computational physicist are on YouTube. The videotaped lectures of the likes of the theoretical physicist **Albert Einstein** are the most truthful, irrefutable, and permanent measures of their intelligence and scientific knowledge and their understandings of their contributions to knowledge.

Emeagwali YouTube Channel

I've posted on YouTube the details of how I discovered that processing with up to a billion processors is the technology that makes computers **faster.** And makes the supercomputer the **fastest.** My technology is used to solve the most compute-intensive problems in science and mathematics. I've posted one thousand podcasts and YouTube videos on my contributions to science.

With 330 million people, the U.S. is only 4.3 percent of the world's population of 7.7 billion people. There are five thousand three hundred universities in the U.S. alone. And there are as many YouTube channels for those universities. In **YouTube**

searches, closed-captioned and high-resolution videos are ranked higher. **Google** only searches the contents of transcribed videos. In **Google searching**, my **YouTube** channel "**Emeagwali"** has more searchable video content than the video channels of ninety-nine percent of the 30,000 universities in the world. I make such asymmetrical comparisons, between an individual and each of the 30,000 universities in the world because knowledge shared is knowledge gained. Knowledge sharing makes the world a better place for humans and for all animals. Sharing knowledge reflects leadership. The most important thing we can do with knowledge is to share it, not keep it. The tagline of *CNN* **is this**: "When we know it, you'll know it." I hope that in my 200th birthdate, on August 23, 2154, that my videos will be displayed.

3RD LECTURE: CRAFTING THE FASTEST COMPUTERS

Broadcast 2 October 2021

https://youtu.be/unw7R1tTR48

THE FIRST SUPERCOMPUTER

My contribution to the development of the first supercomputer is this: I invented the first world's fastest computing, as it's executed today.

Because I invented a supercomputer where none existed, I can confidently say that: "After the Fourth of July 1989, an ensemble of the slowest processors in the world can work together to emulate a never-before-seen supercomputer."

As the inventor of the world's fastest computing, my lectures had power and focus. The reason was that only I could give a first-person eyewitness account of that seminal moment in the history of the computer. That Eureka! moment was fifteen minutes after 8 o'clock in the morning of July 4, 1989. When I give advice on how to invent the world's fastest computing, or supercomputing, or solving difficult problems **across** a new Internet that's a new global network of processors, I speak from my unique experience of being the only inventor that invented such technologies.

My knowledge was diametrically opposite to that gained from reading about supercomputers. As well as reading from textbook authors who were describing the inventions of computer pioneers. After half a century of supercomputing, I acquired a deep knowledge that enables me to produce the one

thousand podcasts and YouTube videos in which I lectured impromptu. I discovered the world's fastest computing and did so without notes that were copied from textbooks.

For the record, the world's fastest computing community of the 1980s was comprised of only one member within parallel supercomputing. And twenty-five thousand members within vector supercomputing. In the 1980s, I was the only person in the field of parallel supercomputing that executed the world's fastest computing.

My discovery of the world's fastest computing **across** the world's slowest processors is my contribution to the development of cheaper and faster computers. The world's fastest computing wasn't just a technology that I invented. It's who I am.

For nearly every day of the past half century, since June 20, 1974 to be exact, I conducted mathematical research on how to harness up to one billion processors that encircled a globe as an Internet. And use them as one cohesive supercomputer. The fastest computers are used to answer the biggest questions in science, engineering, and medicine. Such questions include supercomputing the social distancing requirements during a global pandemic. For those reasons, the world's fastest computing will remain at the core of who we are.

The world's fastest computing is used to find answers to big scientific questions that are central to tackling the global

challenges that face humanity, such as supercomputing the social distancing that reduces the spread of coronavirus. The world's fastest computing **across** the world's slowest processors is a transformatio**nal** discovery that redrew the boundaries of science, and permanently changed what we know about the computer. And how we think about mathematics.

The world's fastest computer is powered by millions of processors. And the hardest problems in mathematics and physics are solved by dividing each grand challenge problem into up to a billion less challenging problems. And then solving them in tandem. And with a one-to-one correspondence with as many processors.

The grand challenges of supercomputing are the most pressing problems of our time. One such challenge is to execute the detailed computational fluid dynamics model of the spread of the coronavirus **across** the one million shoulder-to-shoulder traders in Lagos markets. Fastest computing **across** millions of processors is the path to the solution of the most difficult problems arising at the crossroad where new physics, new mathematics, and new computing intersected.

The invention of a new supercomputer led to the creation of the new computer science of parallel processing. That new science became an instrument of discoveries that transformed lives. The **Philip Emeagwali Computer** is a supercomputer

that's developed in a new way, namely, powered by up to a billion processors. It's also a new Internet that's a new global network of up to a billion processors. Those processors shared nothing but were in constant dialogue.

The mathematician's perennial quest for the world's fastest computing constantly demands fresh faces, new names, and new ideas. During the decade and half onward of June 1974, I was an unknown supercomputer scientist. But I possessed the then unproven idea of harnessing millions of the world's slowest processors. And using them to cooperatively solve the most difficult problems in mathematics. Such compute-intensive problems could not be solved on a single giant processor.

When I began my mathematical quest—back on June 20, 1974, in Corvallis, Oregon, USA—the world's fastest computing **across** the world's slowest processors was merely a theory, or an idea that's not positively true. Since 1974, I believed what I felt in my gut and know in my heart. I believed that harnessing the power of up to a billion processors will leave the realm of science fiction to become reality. And produce the world's **first supercomputer**, as it's known today and as it could be known tomorrow.

In computer science, recording the world's fastest computing and recording it in an unexpected way—such as **across** the world's slowest processors—is the gold standard that

earns its inventor the highest award that's referred to as the Nobel Prize of Supercomputing. I was the first and only person to win that award **alone**, back in 1989.

One Day We Had to Run!

The period of early **1967** was an era of widespread reprisal attacks against Igbo-speaking people who were living in the northern region of **Nigeria**. In late September **1967**, Igbo-speaking people who were living in the midwestern region of **Nigeria** were killed in reprisal attacks from the Midwest military invasion of the Biafran Army. In faraway Northern Nigeria, houses belonging to Igbos were burnt. And their stores were looted. **Igbos** pursued by mobs hid with **Hausa** friends. Some changed their Igbo names to **Hausa** names. In 1967, pursued **Igbos** in Northern **Nigeria** were smuggled into safer neighborhoods.

Back then, there was no inter-city bus transportation in **Nigeria**. My family travelled from Agbor to Onitsha in small Peugeot 403 sedans that squeezed in eight passengers. We also travelled by "*gwon gwo ro,*" a truck, a rickety lorry with a wooden body. Such *trucks* were used by market traders for their long-distance transportation of farm produces, such as yams, chickens, and goats.

In early May **1967**, the political crisis in **Nigeria** remained unabated. Within a six-month period, **Nigeria** lost two political leaders. The Prime Minister of **Nigeria**, Abubakar Tafawa Balewa, was assassinated on January 15, **1966**. Six months later, the new military President of **Nigeria**, Major-General Johnson Aguiyi-Ironsi, was assassinated on July 29, **1966**.

The assassination of the Prime Minister of **Nigeria** spurred reprisal killings of Igbo-speaking people who were living in the northern region of **Nigeria**. As the violence spread, Igbo refugees fled to their ancestral homelands. Reacting to the 30,000 Igbos killed in the street uprisings in Northern Nigeria which followed the second, retaliatory military coup of July **29**, 1966, the *Daily Sketch*, a Lagos newspaper, pleaded for sanity in Nigeria. The *Daily Sketch* asked:

> "Will no one save Nigeria?... Is there no one whose love for Nigeria transcends love of tribe or personal safety, who is willing to come forward and seek others like himself to nurse this sick nation? If there be a man, let him come forward. Today, for God's sake!"

My answer to the question **"Who will save Nigeria?" is this**: Nigeria cannot be saved by one superhero. Nigeria can be saved by 230 million **detribalized** Nigerians. Or heroes and heroines who don't vote along religious, ethnic, and regional sentiments. And who don't call for the dissolution of Nigeria into three countries, the republics of **Biafra, Oduduwa**, and **Arewa**. The breakup of Nigeria is unacceptable to me.

From January **1966** and later, tensions were high throughout Nigeria. In response, my father decided that **Agbor** was no longer safe for us to live in. We rented a *gwon gwo ro* to transport us from the Nurses' Quarters of the General Hospital, **Agbor**, to our second and safer residence at 4B Egbuna-Adazie Street, **Onitsha**. Onitsha was a commercial city that was 47 miles east of **Agbor**.

A Refugee in Our Country

The seats of the *truck* were bare wooden planks and were very uncomfortable. The *gwon gwo ro* we rented was crammed with three chairs, two beds, a double-barrel gun, a Raleigh bicycle, a singer-brand sewing machine, cooking utensils, and various household items. My family returned to **Onitsha** in early May **1967. Onitsha** is our historic homeland at the east bank of the River Niger. Although **Onitsha** was only 47 miles away from **Agbor,** that journey took three hours.

From early May **1967** to the first artillery bombardment of **Onitsha** which occurred on the Fourth of October **1967**, we lived in my parent's house that was at 4B Egbuna-Adazie Street, **Onitsha**. That house was built five years earlier. And my father stayed back in the Nurses' Quarters of the General Hospital, Agbor.

The Midwest Invasion of 1967

He was in **Agbor** during the Midwest invasion of **1967.** That invasion of the mid-western region of Nigeria was executed by 3,000 lightly armed Biafran soldiers. That invasion began at three o'clock in the morning of August 9, **1967.** And began when **Biafran** soldiers crossed the Onitsha-**Asaba** bridge and occupied the entire Midwest Region. By 5:30 of that same morning, the regional headquarters of the Midwest Region, **Benin City,** was under the control of the **Biafran** Army.

A Nigeria Divided into Three Nations

When we received the news that **Benin City** had been captured by the "gallant Biafran soldiers," we ran into the streets of **Onitsha** to celebrate that victory. On August 12, **1967**, the Biafran Army captured the city of Ore that was deep inside the western region of **Nigeria**. In **Biafra**, the capture of Ore was widely celebrated as a strategic victory. The capture of Ore placed the Biafran Army a mere 130 miles from **Nigeria**'s capital, **Lagos**. In **Onitsha**, we speculated that the civil war might not last long. And that the Nigerian Army will soon surrender to the Biafran Army.

The three thousand Biafran soldiers who overran the vast mid-western region of Nigeria were lionized as heroes. **Biafrans** were amazed that the mid-western region was captured within three hours. And captured without firing a single bullet. We were surprised by the boldness of those three thousand **Biafran** soldiers who captured the mid-western region of **Nigeria**.

Those **Igbo** soldiers were commanded by a **Yoruba** officer, named Victor **Banjo**. Major-General Victor **Banjo** was a disaffected Yoruba soldier, who defected from the Nigerian Army to the Biafran Army. On August 9, **1967**, the day the Biafran Army captured the mid-western region of **Nigeria**, my father was in that region and was working as a nurse at the General Hospital, **Agbor.** The Biafran Army claimed to have "liberated" the mid-western region.

On September 19, 1967, the Biafran government renamed the mid-western region of Nigeria as the "Republic of Benin." That same day, the Biafran leader, General **Odumegwu Ojukwu**, appointed Major-General Albert **Okonkwo** as the Military Administrator of the new Republic of Benin, between Biafra and Nigeria.

THE EMEAGWALI INTERNET: ACHIEVING THE UNIMAGINABLE

A New Way of Seeing

The story of how I discovered the world's fastest computing across the world's slowest processors and across an Internet that's a global network of those processors began on June 20, 1974. My story began in a small room that was upstairs of a white house at 195A Knox Street South, Monmouth, Oregon, USA. Oregon is one of the whitest states in the USA. The city of Monmouth (Oregon) that I was living in had no resident Black couple. In 1974, I was a lone Black supercomputer geek in Oregon. And I programmed supercomputers at the same time Steve Jobs was a personal computer geek in Portland (Oregon).

Three Cornerstones of Supercomputing

Fast-forward sixteen years, and my story was in the news. My story that began in a small room in Monmouth (Oregon) was in millions of living rooms across the world. Physics, calculus, and algebra are the **three cornerstones** of fastest computing. The root of computing can be traced to the Middle Ages. The

historical path to the world's fastest computing began 330 years ago. It began as the discovery of the Second Law of Motion of physics. It began as the invention of the technique of calculus that's the most powerful technique in mathematics.

Philip Emeagwali Internet

In the 1980s, the biggest challenge in computer science was to invent how to compute 65,536 times **faster.** And do so **across** a new Internet that I visualized as a new global network of 65,536 off-the-shelf processors and standard parts. That new Internet needed its first programmer who could harness it as the world's fastest computer. That first programmer must be a triple threat at the frontiers of in physics, mathematics, and computing.

Supercomputing Across the Philip Emeagwali Internet

The intellectual and the physical instruments that were required to make those mathematical and scientific discoveries, such as the world's fastest computing, were the knowledge of the laws of classical physics, the mastery of the partial **differential** equations arising beyond the frontier of calculus, the knowledge of large-scale algebra, and the expertise of how to program a processor to solve the most difficult mathematical problems that

are compute-intensive. And the knowledge of how to communicate via sixty-four binary thousand email addresses that each had no @ sign or dot com suffices. And how to exchange the initial and boundary conditions **across** one binary million bidirectional, regular, short, and equidistant email wires. And to, finally, compute **simultaneously** and do so at 65,536 off-the-shelf and coupled processors that shared nothing, but were in dialogue with each other.

Physics is the Thread Across a Million Processors

The laws of physics are the essences and the common thread through the partial **differential** equation arising beyond the frontier of calculus, through the partial **difference** equation of large-scale algebra that approximates that partial **differential** equation, through the compute-intensive fluid dynamics code that was derived from that algebra and emailed **across** that small copy of the Internet that I invented as a global network of processors.

Contributions of Philip Emeagwali to Science

A question in school essays **is this**: "What is the contribution of **Philip Emeagwali** to the development of the computer?"

In 1989, I was in the news because I discovered how to always perform the world's fastest computing. And how to record such speeds **across** an Internet that's a global network of the slowest processors in the world. My contribution to the development the world's fastest computer wasn't too small as a journal paper. Or too large as computer science.

In 1989, I was widely recognized for my contribution to a new and critical technology. That contribution is the world's fastest computing **across** the world's slowest processors. The new knowledge of the world's fastest computer that I contributed to computer science is used to manufacture the fastest computers of today which are expected to become the computers of tomorrow. My contribution went beyond discovering an increase in the speed of the world's fastest computer. My contribution to developing the supercomputer included fighting scientific dogmas.

Finding the Magic Sword for Supercomputing

I faced many obstacles during my fifteen-year quest to discover how fastest computing across a billion processors could become the magic sword to be used to solve the hardest problems.

For instance, on three occasions, in 1977, 1981, and 1989, when the word got out that I was conducting research on the world's fastest computing **across** the world's slowest processors, the governmental fellowships that partially supported my research were withdrawn. My fellowships were cut off as retribution and punishment for pursuing the fastest computer speed that was then in the realm of science fiction.

Why is Mathematics Useful for Nigerian Oil Fields?

Two often-asked questions are these: First, how do we use mathematics in our everyday life? Second, why is mathematics useful in pinpointing the locations of crude oil and natural gas that were buried one mile deep in the Niger Delta oil fields of southern Nigeria.

The young African mathematician needs to understand those parallel-processed solutions used to discover and recover otherwise undiscoverable and unrecoverable crude oil and natural gas that are buried up to 7.7 miles (or 12.4 kilometers) deep. And buried **across** the 65,000 producing oil fields in the world, including the 159 oil fields that dotted the 36,000-square-

kilometer Niger Delta region of southern Nigeria. An oil field is about the size of a town.

BREAKING THE COMPUTING'S SPEED OF LIGHT

Fastest Computing to Solve Compute-Intensive Problems

Solving the most compute-intensive problems in science and society requires a leap of the imagination. Solving a Grand Challenge Problem of computer science is in a way akin to slaying the fire-breathing dragon of ancient mythologies. Or the super dragon that guards the tree of knowledge.

The research supercomputer scientist needs two swords to slay that dragon. The first sword is **intellectual** and is needed for the theoretical discovery of fastest computing. The second sword is **physical** and is needed for the experimental discovery of the world's fastest computing.

Solving the Nine Philip Emeagwali Equations

An often-asked question **is this**: "Is the system of Philip Emeagwali equations solved?"

The reason my discovery of the fastest computing made the news headlines, in 1989, was that I went beyond harnessing the total computing power of the slowest 65,536 processors in the

world. I visualized my processors as evenly distributed around the surface of a sixteen-dimensional globe that was embedded within a sixteen-dimensional hyperspace.

But it took me sixteen years and several stages to discover the first world's fastest computing across the world's slowest processors. First, I mathematically invented the correct equations, namely a system of nine coupled, nonlinear, time-dependent, and state-of-the-art partial **differential** equations occurring beyond the frontier of calculus. That contribution to mathematics is called the **Philip Emeagwali** equations.

Second, I invented algebraic algorithms that I used to solve my correct nine partial **differential** equations that encoded the Second Law of Motion described in physics textbooks. The 65,536 processors of my new Internet can't be harnessed and used to solve an **incorrect** system of equations of algebra and calculus. And harnessed to solve them **correctly**. Nor can those sixty-four binary thousand processors be harnessed to execute an inaccurate algorithm and execute them accurately.

Third, I visualized my new Internet as defined in the shape of a square and outlined in the shape of a circle. In three-dimensional space, those shapes become a cube and a sphere, respectively. In sixteen-dimensional hyperspace, those shapes become a hypercube and a hypersphere, respectively.

VISUALIZING THE PHILIP EMEAGWALI INTERNET

I visualized the Philip Emeagwali Internet in the 16th dimension of space. And visualized my new Internet as a new global network of two-raised-to-power sixteen, or 65,536, identical computers that were defined at the 65,536 vertices of the cube in a sixteen-dimensional hyperspace.

Philip Emeagwali Internet Was My Crown Jewel

Harnessing up to a billion processors to solve the hardest problem and solving it for the first time, on July 4, **1989**, and solving it by executing the world's fastest computing **across** my new Internet is the crown jewel of my discoveries in physics and my inventions in computer science. But the story behind the story is that the technologies are **concrete** and **visible** while the techniques are profound, abstract, and invisible.

The world's fastest computer is up to one billion times faster than your computer. The fastest computer is the heavyweight champion of the computer world. The world's fastest calculation that I discovered and invented **across** my new Internet was the **crown jewel** that sparkled in the limelight and remains echoic retentive in the public memory.

Fastest Computing Across Philip Emeagwali Internet

My scientific discovery of the world's fastest calculation received spontaneous applause, in **1989.** The supercomputing community mirrored back their appreciative applause and recognized my **contribution** to computer science by giving me their highest award. Attempting to find my "fastest calculations within a **fastest computer**" that was powered by a powerful processor was like undertaking to find the unicorn that was a legendary beast with a single, spiraling horn. The unicorn can't be found for the simple reason it does not exist.

My fastest calculations did not exist within one isolated super-fast processor which was not a member of an ensemble of processors. My fastest calculations only exist **across** a new Internet. The machinery that I used to record my world's fastest computing only exists as a new Internet that I defined by my 65,536 **equidistant** processors.

My quest for the world's fastest computer was for a new Internet that I could use to compute at the fastest possible speed. And compute two-**raised**-to-power sixteen times **faster than** the computer. And compute fastest while solving the hardest problems, such as simulating global warming. My quest was for

human progress that's achieved via an increase in the speed of the computer.

In my quest for the world's fastest computer, I followed sixteen mutually orthogonal, or **perpendicular**, directions. Those directions led me into an imaginary sixteen-dimensional hyperspace where I invented my new Internet. And invented it as a new global network of 65,536 **equidistant** off-the-shelf processors that were surrounding a globe in that sixteen-dimensional **hyperspace**.

INVENTING THE FIRST SUPERCOMPUTER

Solving Compute-Intensive Algebraic Problems

Algebra and calculus are the cornerstones of extreme-scale computational physics. In the 1980s, the most compute-intensive problems arising in large-scale algebra are those from discretized partial differential equations beyond the frontier of calculus and not in any textbook.

The grand challenge in late 20th century calculus was to discover how to parallel process, or how to solve 65,536 compute-intensive problems in algebra or calculus and how to solve them across as many processors. Many articles, including one in the June 20, 1990, issue of *The Wall Street Journal*, credited Philip Emeagwali for inventing how to solve such difficult mathematical problems.

I discovered how to solve the most compute-intensive problems. And solve them across a new global network of 65,536 processors. Those processors were identical, coupled, and shared nothing. They defined and outlined a new Internet. I invented how to harness that new Internet and use its processors to compute together and harness up to a billion processors as one

coherent, seamless supercomputer that was the **precursor** to the world's fastest computer. I'm the only father of the Internet that invented an Internet.

Fastest Computing Was Once Impossible Across Processors

The answers to the biggest questions don't come easy. In a syndicated newspaper article that was **distributed** on September 2, **1985** and **distributed** to the print media and **distributed** by the United Press International, or UPI, and in that article, **John Rollwagen,** the president of Cray Research Incorporated, the company that manufactured seven in ten supercomputers, described his company's use of 64 super-fast processors as "more than we bargained for."

My Invention Opened the Door to the World's Fastest Computer

My scientific discovery of the world's fastest computing could be described as follows: A billion processors could be harnessed to compute a billion times faster than one computer. I was in the news because I discovered the supercomputer solution of the hardest problems **across** an Internet.

My theorized Internet was a global network of a binary billion processors. A binary billion is two-**raised**-to-power-32, or 4,294,967,296. My new mathematical solution demands serious ideas and hard work. The reason the twelve-year-old writes an essay on **Philip Emeagwali** is that I **discovered** the world's fastest computing. And discovered how to solve a **billion** problems **at once**, and across an Internet that's outlined and defined by a global network of one billion processors that shared nothing with each other.

My discovery made the news headlines because it **opened the door** to the world's fastest computer that solves a billion problems **at once**, or in tandem.

Changing the Way We Look at the World's Fastest Computer

Silent but powerful protests followed my discovery of the world's fastest computing. My supercomputer discovery which occurred on July 4, 1989, was this: I discovered a significant shift in supercomputing thinking. In the latest thinking, the world's fastest computer must harness **one billion** processors. And must use those processors to solve the world's biggest problems that formerly took **one billion** days (or 2.74 million

years) to solve and, instead, solve them faster and in only one day.

World's Fastest Computer

In the search for new knowledge about nature and man-made things, the discovery and invention are the most coveted contributions to science and technology, respectively. For the computer scientist, the most significant progress is made when the world's fastest computer
becomes faster.

Each year, the computer gets faster but it's difficult to articulate what a specific person contributed to develop that year's computer. The quantum increases in both the speed and speedup of the world' fastest computer that I discovered at 8:15 in the morning of the Fourth of July 1989, in Los Alamos, New Mexico, USA, is the quantifiable and objective measure of my contribution to the development of the computer. That quantum increase in speed was how I corrected the erroneous belief that was enshrined into computer science textbooks.

Prior to my discovery of the world's fastest computing, it was believed that the hardest problems could not be chopped up into a billion less challenging problems. And then solved, in

tandem and with one-problem to one-processor correspondence, and **across** a billion processors. It was believed that the world's fastest computer, as we know its technology today, will forever remain in the realm of science fiction. A research and development on a billion-dollar supercomputer is a financial contribution to the world's fastest computer.

Often, the research article is not a contribution to human knowledge. The research becomes a significant contribution to computer science, if and only, it yielded a new world's fastest computer that made the news headlines and won the most coveted prize in supercomputing, and has other signifiers that it's a significant contribution that made the world a better place and a more knowledgeable place.

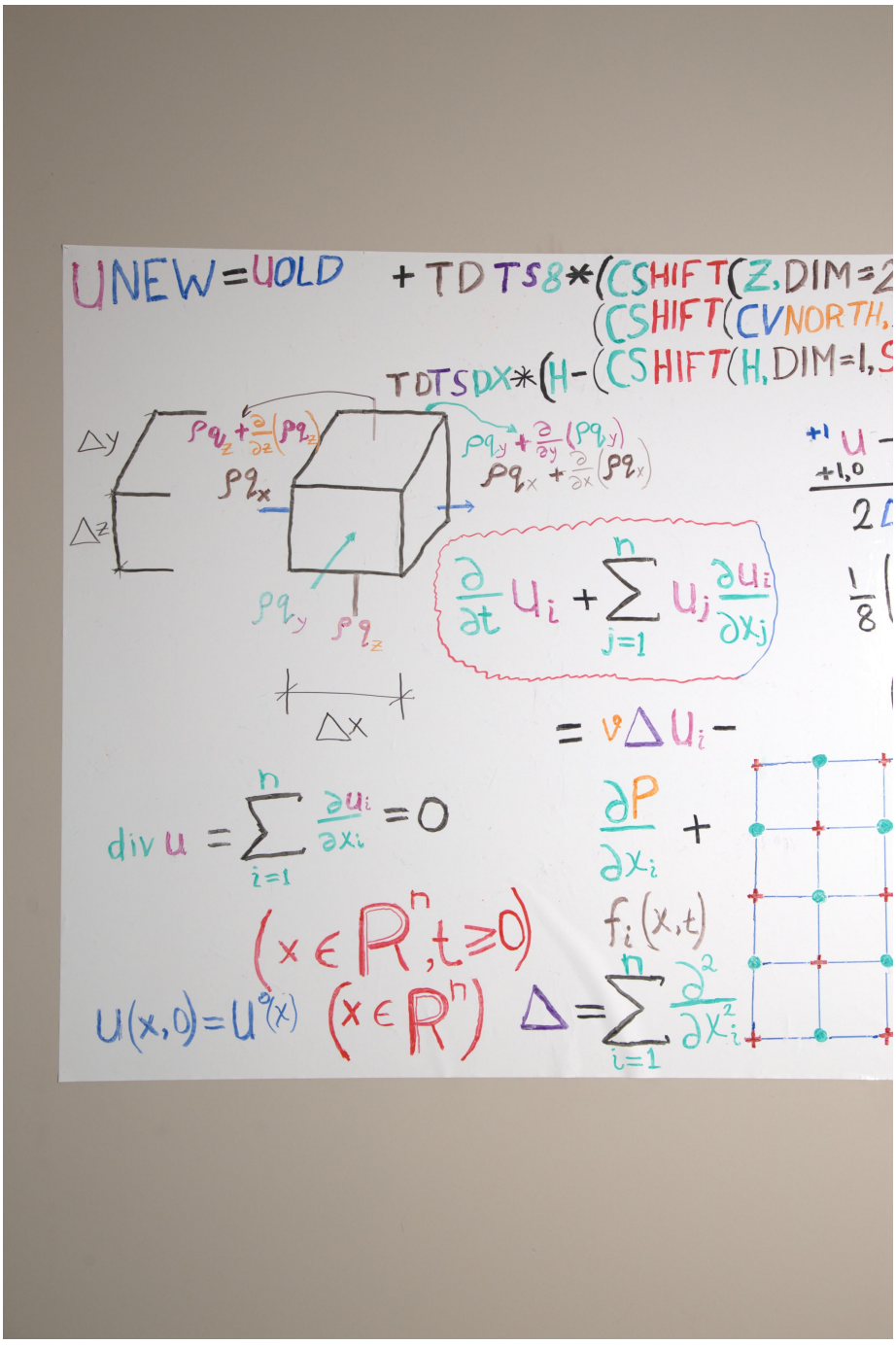
How I Solved the Most Difficult Problem in Supercomputing

During my first fifteen years of supercomputing that followed June 20, 1974, in Corvallis, Oregon, USA, I identified a lacuna in computer science that existed across an ensemble of a billion processors that's wired together as one coherent unit that's an Internet. That missing knowledge was how to harness a billion processors. And use them to solve the most compute-intensive problems in mathematics, science, engineering, and medicine.

I contributed new knowledge, or scientific discovery, to the **first** world's fastest computing **across** the world's slowest processors. I did so by correcting the imprecise knowledge of supercomputing that was known in computer science textbooks as **Amdahl's Law**.

Correcting Amdahl's Law of Diminishing Supercomputer Speed

In simple terms, **Amdahl's Law** stated that fewer than eight processors could be harnessed and used to solve the world's biggest problems. I corrected that error when I harnessed a new Internet that's a new global network of 65,536 processors. And used that new Internet to solve one of the most difficult problems, called an initial-boundary value problem of mathematical physics. Such mathematical problems couldn't be solved otherwise, or without using one million processors.



Philip Emeagwali's mathematical statement of the initial-boundary value problem governing fluid flows.

FASTEST COMPUTING IS MY CONTRIBUTION TO TECHNOLOGY

Solving Compute-Intensive Problems

The world's fastest computing can't be invented by luck. My invention is the product of a sixteen-year-long quest. During my first decade and half of fastest computing, I analyzed the toughest problems in algebra, calculus, physics, and computer science. And I tried different ways of solving initial-boundary value problems that were governed by a system of partial differential equations at the frontiers of calculus and computational fluid dynamics.

I theorized my parallel-processed solutions both within one processor and across one billion processors. I did both before I discovered that the fastest computing across the slowest processors is not a waste of everybody's time, as was presumed prior to July 4, 1989.

Fastest Computing is My Signature Contribution to Computer Science

It costs about half a million dollars to train a pre-eminent mathematician. And train her from the first grade to the frontier of mathematical knowledge. But paying half a million dollars to consume the mathematical knowledge that was created by preceding research mathematicians is not a contribution to the existing body of mathematical knowledge.

Inventing new partial **differential** equations that occurs at the frontiers of calculus and physics and inventing the fastest computing across the slowest processors and using that new knowledge as the tool for solving those difficult mathematical equations were my two signature contributions to modern mathematical knowledge.

For those reasons, I was the cover story of the top mathematics publication, the May 1990 issue of the *SIAM News* that was the flagship publication of the Society for Industrial and Applied Mathematics. Mathematics publications featured me to mathematicians not because I was good looking. I created new mathematical knowledge that no mathematician had understood before.

The *SIAM News* is where recent contributions to mathematical knowledge are published. The *SIAM News* featured me because I contributed the nine Philip Emeagwali equations that were a system of partial **differential** equations at the frontiers of calculus and physics. And I contributed new

knowledge of how to solve them by supercomputing them **across** millions of processors that shared nothing between each other. In 1989, I was in the news because I invented how to solve initial-boundary value problems of mathematical physics. And solve them by supercomputing them across the slowest processors in the world. For that contribution, I won the highest award that computer scientist describe as the Nobel Prize of Supercomputing.

How Are Supercomputers Used in Saudi Arabia?

In an email, a fourteen-year-old writing an essay on famous computer scientists and their contributions to the development of the computer **asked me**: "How are the contributions of **Philip Emeagwali** used in Saudi Arabia?" The supercomputer market is valued at forty-five billion dollars a year. The energy and geoscience industries buy one in ten supercomputers. And use them to pinpoint oil deposits.

The Ghawar Oil Field of **Saudi Arabia** that was discovered in **1948**had up to 104 billion barrels of recoverable oil reserves. The Ghawar Oil Field measures 174 miles by 19 miles. The Ghawar Oil Field is declining at eight percent **each year**. Supercomputing across a billion processors is the forty-five billion dollars a year high-performance computing technology

that must always be used to recover crude oil and natural gas from the Ghawar Oil Field. **Saudi Arabia classified** its fastest computer simulations of its oil fields as a state secret and proprietary intellectual property.

In 1989, I was in the news for discovering how the world's slowest processors could be harnessed and used to manufacture the world's fastest computer. And used to pinpoint the locations of otherwise elusive crude oil and natural gas that were formed up to 541 million years ago. And buried up to 7.7 miles (or 12.4 kilometers) deep. And buried **across** an oil producing field that's the size of a town.

The most important applications of mathematics, physics, and computer science occurs within the world's fastest computers. The world's most expensive computer costs one billion, two hundred and fifty million dollars. The world's most expensive telescope costs ten billion dollars. The world's fastest computer is to the mathematician what the world's biggest telescope is to the astronomer.

4TH LECTURE: BEYOND THE LIMIT OF COMPUTING

Broadcast 2 October 2021

https://youtu.be/B41TfZBk7M8

Changing the Way We Look at the Supercomputer

Year Million Posthuman Computers An Internet of Posthuman Gods

n 1989, I was in the news for providing the “final proof” that supercomputing across the world’s slowest computers is not

I science fiction. Science deals with facts while fiction deals with truths. Fast computing across 64,000 human computers was first theorized as science fiction, back on February 1, 1922. But for seven decades, the idea of fast computing in tandem and across thousands of computers was dismissed for the lack of evidence. In those years, the technology could not be harnessed and used to power the world's fastest computers.

My contribution to computer science that's the subject of schools essays **is this**: I experimentally confirmed the **first** world's fastest computing **across** the world's slowest processors. I discovered the "final proof" that the slowest processing **across** thousands of processors could yield the fastest computing. I made that supercomputing discovery sixty-seven years later, on July 4, 1989, in Los Alamos, New Mexico, USA.

Solving the world's biggest problem across a million processors is to the world's fastest computer what playing games with only one processor is to the regular computer. Parallel processing takes computer science into a new epoch where millions of processors **work together** to power only one supercomputer.

At 8:15 in the morning, on July 4, 1989, in Los Alamos, New Mexico, USA, I became the first person to stand at the farthest frontier of the world's fastest computer. I was the first

person to gaze out towards unknown territories that were not on the map of computer science. I gazed **across** an ensemble of the world's slowest processors to discover the world's fastest computing which was then unknown to mathematicians and physicists who needed that new knowledge to solve their most difficult problems. That then unknown field of knowledge is where unexpected and unimagined new computer science, new physics, and new mathematics are almost guaranteed to be discovered.

The world's fastest computing represents a remarkable confluence of new ideas from the frontier of mathematics to those of physics and computer science. My contribution to computer science **is this**: I was the first person to synthesize the new multidisciplinary ideas. And do so with new ideas of my own. I synthesized ideas to discover that the world's fastest computing hid in the bowels of an ensemble of the world's slowest processors.

It's not only the supercomputer that will benefit from my discovery of the fastest computing **across** the slowest processors. Our understanding of the supercomputer will increase over the coming years. I believe that the Internet will evolve to become one coherent computer, or a planet-sized supercomputer.

One million years ago, our prehuman ancestors looked like apes. In one million years, or Year Million, our posthuman Gods

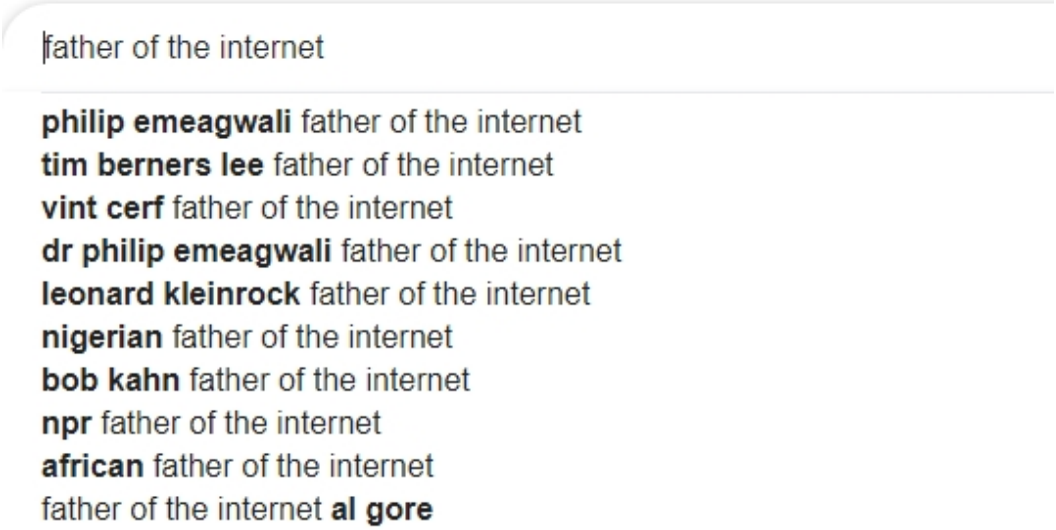
might ridicule our descendants as looking like humans. We might have only living Silicon as our posthuman Gods that could achieve immortality.

In the distant future, the aliens on Earth could be us. And the posthuman Gods on distant planets could be our descendants. I envision posthuman Gods of Year Million as thinking **across** a Cosmic SuperBrain that is an artificial intelligence. That human-made genius could sprawl **across** an epic landscape to become their eighth supercontinent. That powerful brain could enshroud our seven land continents and enshroud the Earth with their Year Million electronic wires.

I foresee our descendants being part-humans and part thinking machines. The grandchildren of our grandchildren may not use their Internet the way we use our Internet. Their Internet could be within them while our Internet is around us. Posthuman Gods will not need supercomputers because they could **be** infinitely fast computing machineries.

PHILIP EMEAGWALI

INTERNET



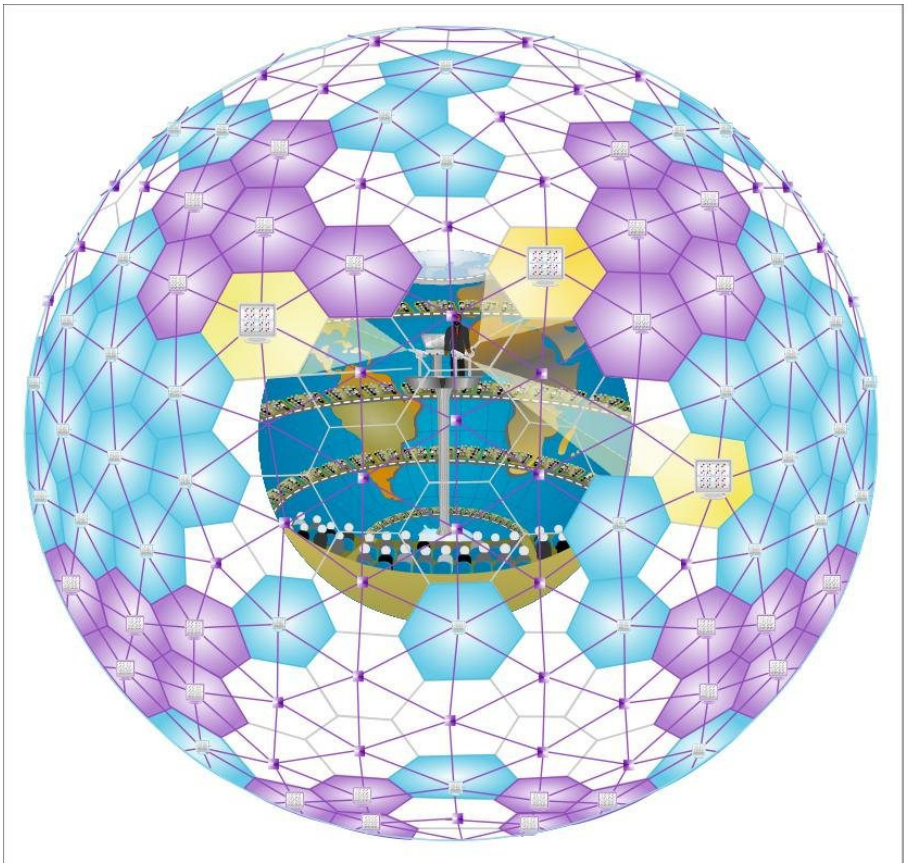
Google ranks Philip Emeagwali as the father of the Internet (Labor Day 2019).

In 1989, it made the news headlines that I—Philip Emeagwali—had experimentally discovered how to solve some of the most compute-intensive problems in mathematics and physics. I was cover stories because I discovered how to

solve the most difficult problems in mathematics and physics. And solve them with the world's fastest computer that was powered with the world's slowest processors.

Furthermore, I invented how to solve the hardest problems, called extreme-scale computational fluid dynamics. Likewise, I invented how to solve difficult mathematical problems **across** a new Internet that's a new global network of up to one billion coupled processors. Each processor operated its operating system and shared nothing. I was in the news because I invented a new Internet that's a new global network of millions, or billions, of processors.

I invented how to parallel process or how to execute a **billion** set of computer instructions. And how to execute them **at once** or how to execute them in parallel and **across** a **billion processors.** My invention of how the world's fastest computer can be built from the slowest processors enables the supercomputer to compute a **billion** times **faster** than the regular computer.



The earliest blueprint for the Philip Emeagwali supercomputer that's Internet that was conceived in 1974, in Corvallis, Oregon. Philip Emeagwali is the only father of the Internet that invented an Internet.

My Earliest Years in Computing

I began my quest for that new Internet in **1974** in Oregon, USA. I began as a janitor-mathematician who put away his **slide rule**, that was also called an analog computer, that he bought in **1970** and brought from Onitsha, **Nigeria**. In late 197**0,** it seemed like I was the only person with a slide rule in Onitsha (**Nigeria**). I also put away my **log table**, that was my only computing aid, of **1967** at our home that was the Nurses' Quarters of General

Hospital, Agbor, **Nigeria**. I put away both my slide rule and log table to learn how to compute fastest and do so when solving compute-intensive systems of equations in algebra.

Inventing the Nine Philip Emeagwali Equations

In **1974**, in Corvallis, Oregon, USA, I learned how to use the fastest computers to solve those equations arising in computational linear algebra. They were impossible to solve on the blackboard, or solve with pencil and paper. I learned how to solve a huge system of equations of modern algebra and solve them on a supercomputer that was powered by only one electronic brain.

As a research mathematical physicist who came of age in the **1970s** and **80s**, I understood how those difficult mathematical problems arose from some laws of physics. I understood how the new calculus were derived. And how those laws of physics were **encoded** into the system of partial **differential** equations beyond the frontier of calculus. They are called the nine **Philip Emeagwali** equations.

My Earliest Years of Computing in the USA

I made my debut as a computational mathematician on one of the world's fastest computers. I began supercomputing

because I needed to solve a huge system of equations in algebra. I began my supercomputer quest on Thursday, June 20, **1974,** in Monmouth, Oregon, in the Pacific Northwest region of the United States. I entered my programs into a time-shared supercomputer that was at 1800 SW Campus Way, Corvallis, Oregon.

I submitted my executable programs that were written in high-level programming languages, such as **BASIC** and **FORTRAN**. And entered them through my remote job entry terminal. BASIC is the acronym for Beginners' All-purpose Symbolic Instruction Code. It's a general-purpose, high-level programming language. FORTRAN is the acronym for FORmula TRANslation. It's the first choice, programming language of engineers and mathematicians and other creators of scientific algorithms. My knowledge of supercomputers grew over the decade and a half that followed June 20, **1974**.

OVERCAMING RACIAL BARRIERS IN SCIENCE

My Supercomputer Access Was Denied

In the 1970s and 80s and as a Black and African-born, in the USA, conducting a decade-and-half long multidisciplinary research in computational physics, I was effectively banned from using supercomputers.

For that reason, I couldn't conduct research on vector supercomputers that costs about forty million dollars each, in the early 1980s. My accesses to the fastest vector supercomputers were revoked, after they discovered that I was Black and African-born. It was revoked at various institutions, such as the U.S. National Weather Service, Camp Springs, Maryland. And revoked from [the University of Michigan], Ann Arbor, Michigan, for the supercomputer center in San Diego, California, that was operated by the U.S. National Science Foundation.

My Supercomputing Job Offers That Were Rescinded

In July 1985, I was tentatively offered a job, as a supercomputer scientist, at the Great Lakes Environmental Research Laboratories of the U.S. National Oceanic and Atmospheric Administration, in **Ann Arbor,** Michigan. For

practical purposes, I was offered the job via telephone, when they presumed that I was **white**. Two months later, on about September 24, 1985, I was flown into **Ann Arbor,** Michigan, to give my supercomputer hiring research lecture and do so in the lecture auditorium of the Great Lakes Environmental Research Laboratories, in Ann Arbor, Michigan. When the decision makers knew that I was Black and African, they decided not to hire me as their supercomputer scientist.

Fast-forward four and a half years, after that rejection, newspapers in **Ann Arbor,** Michigan, were writing stories about an African supercomputer genius, named **Philip Emeagwali**. I was in the news because I had won the highest award for my contribution to supercomputing. At the Great Lakes Environmental Research Laboratories, the white supremacists were shocked to learn that the Black supercomputer scientist that they interviewed but rejected, four and a half years earlier, is in the news for inventing the first supercomputing **across** the world's slowest **computers**.

Sabotages of My Supercomputing

In 1989, I was in the news for the discovery of fastest computing. That was a scientific discovery that I was supposed to have made at the Great Lakes Environmental Research

Laboratories. Because I was Black and African, I wasn't permitted to make my supercomputer discovery in **Ann Arbor,** Michigan.

As an aside, a search through the eight billion videos that were posted on YouTube will reveal that nobody in [the University of Michigan], Ann Arbor, Michigan, or anywhere else in the world, then and now, had or has the commanding combinations and grasp of mathematics, physics, and computer science that was needed to contribute the new knowledge that will enable the fastest computing across the slowest processors as well as deliver lectures on their contributions to supercomputing that is on par with the one thousand closed-captioned videos that I posted on my YouTube channel named "Emeagwali." This gap in scientific knowledge was widely written about within [the University of Michigan], Ann Arbor, Michigan, and beyond.

Research scientists in [the University of Michigan], Ann Arbor, Michigan, revered my discovery of the world's fastest computing. Their reverence was documented in a special issue on **Philip Emeagwali** in their flagship publication, called *The Michigan Today*. That February 1991 issue of *The Michigan Today* was titled: "One of the World's Fastest Humans."

The *Michigan Today* is a quarterly publication that's mailed to 610,000 alumni [of the University of Michigan]. The PDF version of that February 1991 issue, on **Philip Emeagwali,** can

be searched for and read online. As an aside, that *Michigan Today* issue on **Philip Emeagwali** was used to develop two nation-wide law school admission tests.

In September 2009, the **LSAT** (or Law School Admission Test) of the USA, had a reading comprehension section that focused on "**Philip Emeagwali**" and that drew from that *Michigan Today* issue of February 1991. And in December 2009, the same American Law School Admission Test also focused on my contributions to computer science and drew from that *Michigan Today* issue of February 1991. That reading comprehension section of the American **LSAT** as well as millions of school essays on **Philip Emeagwali** put me on the same platform with **Albert Einstein** and **William Shakespeare**.

Giving that level of recognition to a young Black sub-Saharan African will always incur extreme jealousies from white supremacists who argue that **Albert Einstein** has a higher IQ than **Philip Emeagwali**. In [the University of Michigan], Ann Arbor, Michigan, of 1989, many white supremacists were sad and jealous of all the fame and attention that I was getting. The jealous ones among them had the shaky feeling that they could win that Nobel Prize of Supercomputing and do so if they had access to a supercomputer. They had access to supercomputers, since 1946. But they lacked the scientific knowledge that I

possessed and exhibited in my one thousand podcasts and YouTube videos.

So, I was rejected on September 24, 1985, in Ann Arbor, Michigan, solely because I was Black and sub-Saharan African, not because I lacked the intellect and knowledge. I was the first person to discover the world's fastest computing, as it's known today.

By the early **1980s**, I was ahead in the supercomputer race for the fastest calculation in the world that could be executed **across** the slowest processors in the world. But as a Black supercomputer scientist who worked alone, I was perceived as a threat instead of welcomed as a contributor to supercomputing. In the early to mid-1980s, I was blacklisted and denied access to vector supercomputers that were then the fastest in the world. I was forced to back off just before I could make a supercomputer breakthrough.

How I Won the Top Award of Supercomputing

In **1989**, it made the news headlines that an African supercomputer genius who worked alone had won the highest award in supercomputing. And won it for inventing how to solve a set of 65,536 difficult mathematical problems in large-scale computational fluid dynamics.

At its compute-intensive core, each mathematical problem was a system of **366** equations of computational linear algebra. I solved each system on the slowest processor in the world. I totaled those problems **across** my ensemble of 65,536 processors. Each processor was coupled to its sixteen nearest-neighboring processors. Each processor shared nothing with its nearest-neighboring processors.

In the news articles, I was described as the African supercomputer inventor who invented how to solve those world-record algebraic equations. And solve them **across** a new Internet that's a new global network of 65,536 off-the-shelf processors that were identical to each other.

INVENTING THE PHILIP EMEAGWALI INTERNET

I was the Internet scientist in the news in 1989. My scientific discovery of the fastest computing across a new Internet that's outlined by up to one billion processors occurred on the Fourth of July 1989. My invention was mentioned in the June 20, 1990, issue of *The Wall Street Journal*.

That was my contribution to mathematics. That contribution has diverse everyday applications in science and engineering, such as weather forecasting. That scientific discovery was my Eureka invention as a new Internet scientist. It was my Eureka moment because I discovered two new Internets. I theorized my first Internet in **1974**.

My first Internet was the supercomputer technology which I constructively reduced to practice as my second Internet that was comprised of my new global network of the 65,536 slowest processors in the world. I programed them, in 1989, to execute the fastest computations in the world. And execute them while solving the most difficult problems that arise in mathematics and physics.

My first Internet was unknown in the computer textbooks that were published in 197**4.** That was the year I made my debut

in supercomputing at 1800 SW Campus Way, Corvallis, Oregon, USA. My second Internet was unknown, in 1989, the year I recorded the fastest computer speed. And recorded it in Los Alamos, New Mexico, USA.

Inventing the First Supercomputer

Fastest Computing Across a New Internet My invention of how to solve up to a billion difficult mathematical problems at once and solve them with a one-problem to one-processor correspondence and solve them across a new Internet is the reason for writing school essays titled: "The Contributions of Philip Emeagwali to the Development of the Computer."

Because I wasn't allowed to conduct my scientific research and do so in conventional vector supercomputing, I was forced to change direction. And conduct my research on how to harness the 65,536 slowest processors in the world. And how to use those processors to invent a new supercomputer that is beyond super.

The life lesson that I learned from those rejections **was this**: When one door closes, another door opens. When the door that led to the room that was housing the conventional vector supercomputer closed, the door that led to the building housing the most powerful supercomputer also opened.

How I Leapfrogged to the World's Fastest Computer

Supercomputing Subterranean Fluid Dynamics

I'm a **Nigerian**-born large-scale computational fluid dynamics engineer who came of age in the USA and in the 1970s and 80s. My testbed supercomputing problems for my ensemble of 64 binary thousand processors ranged from global atmospheric flows to the fluid dynamics within an oil producing field that's up to 7.7 miles (or 12.4 kilometers) deep and that covers an area that's often the size of Mogadishu (**Somalia**). As a computational physicist, my supreme quest is to match physics models and simulations to the actual geophysical fluid dynamics being simulated.

Inventing the Shape of the World's Fastest Computer

One of the most difficult mathematical problems is global climate modelling. It has an associated initial-boundary value problem that's formulated at the **crossroad** where modern calculus, computational physics, and fastest computing intersect. That compute-intensive problem is mathematically defined over a physical domain.

For my global climate models, I visualized the geometrical shape of the global warming problem as a globe that has a

diameter of 7,900 miles. That globe was enshrouded by a concentric sphere that has an inner diameter of 7,900 miles and an outer diameter of 7,962 miles. The inner diameter of that globe was my geometrical metaphor for the surface of the Earth. The outer diameter of that globe represents the limits of the atmosphere of the Earth.

Breaking the Barriers of Computing

My contributions to the invention of the first world's fastest computer, as it's known today, **were these**: At 8:15 in the morning of the Fourth of July 1989 in Los Alamos, New Mexico, USA, I jumped in joy because I discovered the fastest computing **across** the slowest processors. I invented the technology as the new world's fastest computer that's defined **across** the slowest processors in the world.

That new supercomputer that made the news headlines wasn't a computer, by or in itself. I visualized my new supercomputer as my new Internet, in reality. That new Internet was a new global network of off-the-shelf processors that were parallel processing as one seamless, coherent, and gigantic supercomputer. And computing together to solve the world's most important and complex challenges.

INVENTING THE PHILIP EMEAGWALI INTERNET

I first discovered the first world's fastest computing across my theorized Internet that's a new global network of sixty-four binary thousand, or two-raised-to-power sixteen, processors. My processors were identical and shared nothing. I visualized and theorized my 65,536 processors as identical computers that were evenly distributed around the Earth. I visualized those two-raised-to-power sixteen identical computers as being equal distances apart. And with much uniformity in processors and regularity in email wires.

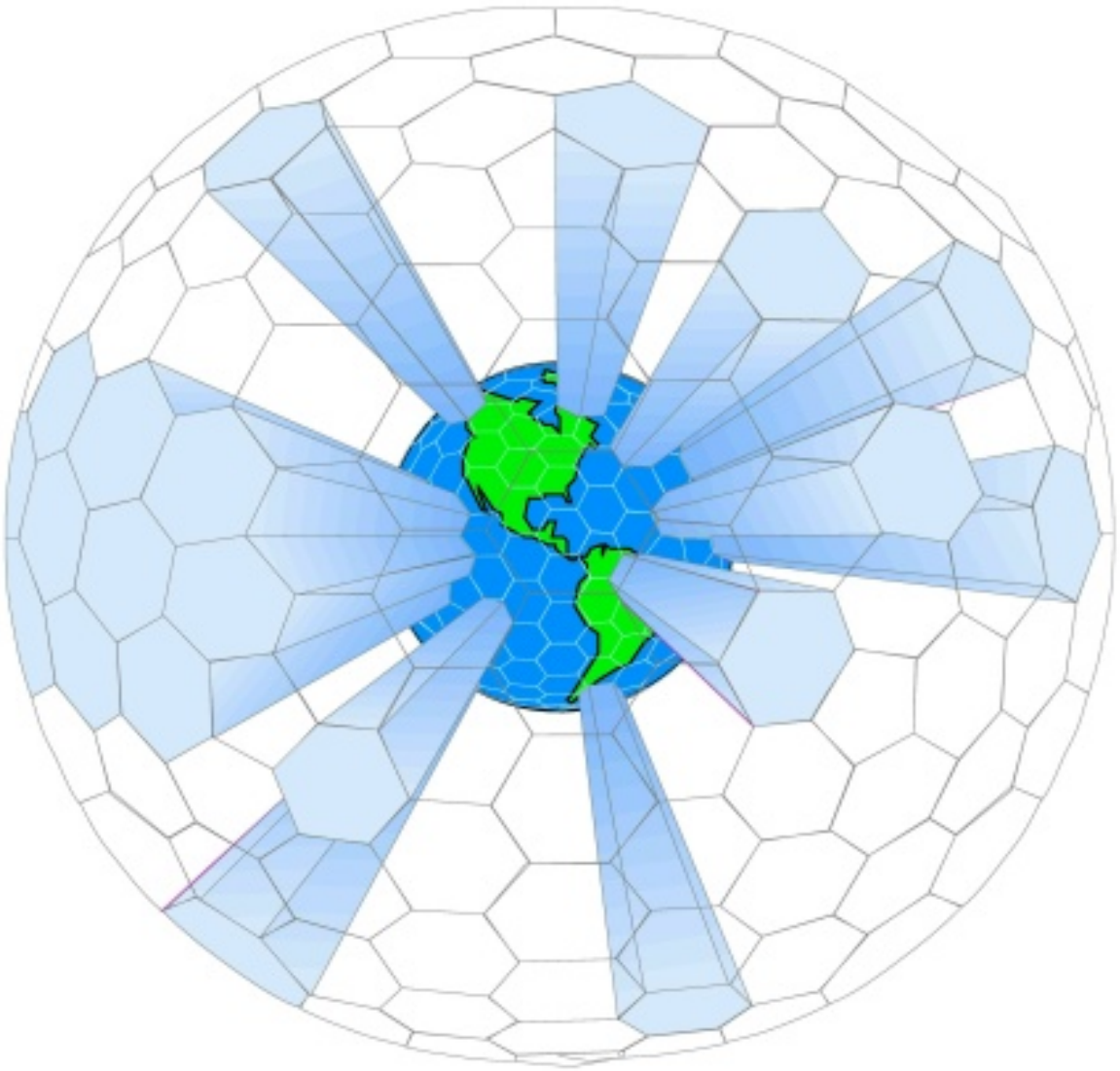
Over the fifteen years that followed June 20, **1974,** in Corvallis, Oregon, USA, my theorized Internet evolved towards a new global network of sixty-four binary thousand processors that I visualized as encircling a ball in my sixteen-dimensional hyperspace. I called that ball a HyperBall. Years later, that name, HyperBall, was replaced by the current name "**Emeagwali Computer**." I visualized the **Emeagwali Computer** as shaped like a hypercube that's tightly circumscribed by a HyperBall.

Fastest Computing at a Crossroad

The world's fastest computing resides at the crossroad where new calculus, the most large-scaled computational physics, and the fastest computing intersect. Because fastest computing **across** a billion processors is a highly **multi**disciplinary field of study, it's problematic to explain where the mathematics ended and where the physics began and where the computer science continued. As a supercomputer scientist who came of age in the 1980s, I've been identified as a mathematician or a physicist or a computer scientist.

In the 1970s and 80s, fastest computing **across** the slowest processors was very complicated and was mocked and ridiculed as science-fiction and as a tremendous waste of everybody's time. In the 1980s, I was the only full-time programmer of the most massively parallel supercomputer ever built. That supercomputer was powered by 65,536 processors.

Today, the world's fastest computer is programmed by up to ten thousand mathematicians and scientists. The reason I programmed such machinery alone, back in the 1980s, was that nobody else understood how to execute the fastest computing. And do so **across** the slowest processors. And record supercomputing speeds that's a million times faster than a computer that's powered by only one processor.



The earliest blueprint for the Philip Emeagwali supercomputer that's Internet that was conceived in 1974, in Corvallis, Oregon.

CHANGING THE WAY WE LOOK AT THE COMPUTER

My contributions to computer science were these: I discovered how to harness millions of processors and use them to reduce the wall-clock time-to-solution. And reduce that time from 30,000 years within one processor to one day across a new Internet that's a new global network of 10.65 million off-the-shelf processors.

My supercomputer invention occurred on July 4, 1989, in Los Alamos, New Mexico, USA. My invention of the first supercomputing **across** the world's slowest computers that outline an Internet made the news headlines because it indicated progress in computer science. And resulted in a fundamental change that changed the way we will look at the regular computers of **tomorrow** that could evolve from the fastest computers of **today**.

The world's fastest computer speed that I discovered and that made the news headlines **was this**: The processing power of the world's fastest computer which now occupies the space of a soccer field can be increased to the power of a theorized supercomputer that could enshroud the Earth in forthcoming

centuries. The world's fastest computer can weigh more than a million pounds, or eight thousand persons.

The supercomputer of the future could be powered by **trillions** of processors that will be communicating as an Internet that enshrouds the Earth. That planet-sized computer could enable discoveries **across** science and industry.

Fastest Computing is a Billion Times Faster than Computing

Simulating Nuclear Explosions

In the **1980**s, I couldn't conduct my research on how to harness one million processors. And use them to solve the hardest problems in science, engineering, and medicine. As a supercomputer scientist, I came of age in the **1970**s and **80**s and in the USA. In those two decades, it was impossible for a Black African-born but naturalized U.S. citizen, such as myself, to gain the top-secret clearance that was needed to work with the world's most powerful supercomputers. The fastest computers are used to simulate the explosions from detonating nuclear bombs.

Black Inventors Were Not Hired

The U.S. national laboratories—not universities and corporations—were the primary places that I could conduct my research in fastest computing **across** the slowest processors. In

the **1980**s, I had the visceral feelings that I was on a hot track to discover and invent how and why a million processors that computed in tandem could be harnessed to make future computers faster and supercomputers **fastest**.

In retrospect, I was pursuing a supercomputer invention—namely parallel computing—that couldn't be invented under the vision of any U.S. national laboratory. Or be invented as part of a supercomputing research team anywhere in academia. That, plus the fact that I was Black and African, was the reason I wasn't hired as a research supercomputer scientist in the 19**70**s and **80**s.

Father of the Internet | A Beautiful Theory that is an Internet

In my unsuccessful hiring talks that I delivered in U.S. government laboratories, I provided broad brushstrokes to research computational physicists. And to research computational mathematicians. Back then, my theories on how to solve the hardest problems and solve them **across** a million processors were dismissed as science fiction.

My idea was ridiculed as a beautiful theory that lacked an experimental confirmation. That beautiful theory was my new Internet that I visualized as a new global network of 65,536 off-the-shelf processors that shared nothing, but were in dialogue

with each other. My broad brushstroke was to solve the most difficult problems in mathematics, science, and engineering. My supercomputing quest was to discover how to solve them **across** my ensemble of two-raised-to-power sixteen processors that were coupled to each other.

In the 19**70**s and **80**s, the world's fastest computer speed that I recorded on July 4, 1989, was mocked as a huge embarrassing mistake. And dismissed as science fiction. Achieving the fastest computing **across** the slowest processors was ridiculed as an empty pipe dream.

MY LEAPFROG FROM COMPUTER TO INTERNET

In 1974, and in Corvallis, Oregon, I made a leap of my imagination. I leapt from a theorized global network of sixty-four thousand human computers that were equal distances apart, and around the Earth, to my theorized global network of sixty-four binary thousand computers that were also uniformly distributed around the Earth. I made that leap of my imagination because that's what humans do. Humans extrapolate from the known to the unknown. The genius is the ordinary person that found the extraordinary in the ordinary.

Why is Supercomputing a State Secret?

The need for faster computers isn't going anywhere. The supercomputer will help define the **political** and **economic** powers of the 21st century. The nation that controls the technology that powers the world's fastest computer controls high-stake seismic imaging and petroleum reservoir simulation. Both technologies must be used to nail down the exact locations of crude oil and natural gas that were formed up to 541 million years ago.

The nations that control petroleum technologies control the 65,000 oil fields in the world. This is the reason **China** wants to control the technology that powers the world's fastest computers. Doing so will enable China to take the first step in controlling some of the 159 producing oil fields in **Nigeria**.

Therefore, it will not come as a surprise that the **Saudi Arabian** government placed armed guards around its most powerful supercomputer. One of the world's fastest computers is used to simulate the recovery of crude oil and natural gas from the vast oil fields of **Saudi Arabia**. **Saudi Arabia** classified the supercomputer simulations of their oil fields as state secrets. They're state secrets because the supercomputer is the key to the petroleum dependent economy of **Saudi Arabia**.

The supercomputer is the magical lock that, so to speak, opens the oil field that's buried up to 7.7 miles (or 12.4 kilometers) deep in the Sakhalin Island in Russia's Far East. And up to twice the size of the state of Anambra, Nigeria.

The Size of the Supercomputer Market The world's fastest computer is not only the pinnacle of the computer industry, but it's also big business. In recent years, the industry grossed forty-five billion dollars a year.

AN INTERNET THAT'S ALSO A SUPERCOMPUTER

Inventing the Supercomputer as an Internet

I'm the only father of the Internet that invented an Internet. The first Internet that I invented was a new global network of processors. I designed that Internet to be congruent with the atmosphere of the Earth. I reasoned that the surface of the Earth is enshrouded by a 62-mile-deep ocean of air, moisture, and water, such as the rivers, lakes, oceans, and even fluids like crude oil and natural gas. Furthermore, I visualized that 62-mile deep body of fluid as a concentric sphere with an inner diameter of 7,917.5 miles (or 12,742 kilometers).

Not only that, I visualized that concentric sphere as tessellated into 65,536 equal-sized ocean of fluids that extended from the bottom of the oceans to the uppermost boundary of the Earth's atmosphere. I had to visualize the shape of my new Internet as follows: My new Internet must circumscribe a globe has a diameter of 7,917.5 miles (or 12,742 kilometers).

I defined my new Internet as outlined as a new global network of 65,536 processors that has a one-to-one correspondence with 65,536 equal-sized physical domains. Each processor within my new Internet will run one climate model.

The world's fastest computer occupies the footprint of a football field. And internally communicates across a total of 200 miles, or about 322 kilometers, of cables. And it costs one billion, two hundred and fifty million dollars each. That world's fastest computer is the top dog in mathematics.

Where is the measurable paradigm shift, or the step-changing discovery, that's the greatest milestone in the history of the computer? Where is the continental drift of supercomputing? The increase in the speed of the supercomputer is the central essence of what defines progress in computing. The world's fastest computer could become the laptop computer of tomorrow.

Speed is the essence of the computer. Therefore, a paradigm shift, or a change in the way we think about the computer, occurs when there's a quantum leap in supercomputer speeds. According to Moore's Law, the speed of the computer is expected to double every eighteen months. However, that factor-of-two increase in computer speed is merely evolutionary and conventional. That factor-of-two increase wasn't a paradigm shifting discovery. Visualization was the key instrument which I used to invent my new Internet that's a new global network of off-the-shelf processors which defined and outlined my new supercomputer.

I used the cube as my metaphor for my new Internet. And I visualized a processor as corresponding to a vertex of the cube.

And a bidirectional email wire as corresponding to each edge of the cube. Furthermore, I visualized my new Internet as a cube that was tightly circumscribed by a sphere.

For my world's fastest computing emails that made the news headlines, in 1989, I visualized my cube as a **hypercube** in the 16th dimension that was circumscribed by a **hypersphere** in the 16th dimension. I visualized my new Internet as defined and outlined by a new global network of sixteen **times** two-**raised**-to-power sixteen, email wires. Or a network of one binary million, or 1,048,576, bidirectional edges of that **hypercube.** I visualized my email wires as projected and as etched onto the fifteen-dimensional **hypersurface** of that sixteen-dimensional **hypersphere** that "circumscribed" it.

Finally, I visualized those edges as my metaphors for my 1,048,576 bidirectional email pathways that emanated to and from my new global network of 65,536 off-the-shelf processors that was my new Internet. I visualized my processors as equal distances **apart** and as corresponding to the as many vertices of the **hypercube** on that **hypersurface**. For these contributions, I'm the only father of the Internet that invented an Internet.

A QUANTUM LEAP IN SUPERCOMPUTER SPEED

At 8:15 in the morning, on July 4, 1989, in Los Alamos, New Mexico, USA, I discovered how to increase the speed of the fastest computer and do so by a factor of 65,536. I recorded my computer speedup across as many processors. On that day, I also discovered how to, in theory, increase that speed by a factor of one billion across one billion processors. I visualized those one billion processors as uniformly encircling a globe and doing so as a new Internet. That new Internet was where I executed the world's fastest computing.

For six months after my discovery of fastest computing, leading supercomputer scientists were shocked at the speed of my calculations. But some supercomputer scientists mocked my discovery of the alternative way of executing the world's fastest computing. And using that new knowledge to solve the most difficult problems arising in mathematics.

The naysayers wrote that Philip Emeagwali has made a "terrible mistake." Those naysayers stopped laughing at me after it was announced that my discovery of the world's fastest computing has been validated. I won the highest award in supercomputing and for the year 1989.

My discovery of fastest computing made the news headlines around the world and became my signature invention. It's the reason Philip Emeagwali is the subject of school essays. Achieving that 65,536-fold increase in supercomputer speed was a fundamental change of tectonic proportions that changed the way we look at the world's fastest computer. Computing across up to a billion processors was a magical change because it was both unexpected and extraordinary. The reason my scientific discovery of the world's fastest computing made the news headlines was that the new technology was both unorthodox and revolutionary.

Unlocking the Power of the Supercomputer to Foresee the Otherwise Unforeseeable

In the conventional paradigm of supercomputing, called serial computing, the computer scientist visualized one processor as computing **automatically** to solve one of the most difficult problems in mathematics. One such problem was the initial-boundary value problem arising at the frontier of calculus and large-scale computational physics. The system of partial **differential** equations that governs such initial-boundary value problems is at the mathematical and computational core of the

highest-resolution global climate model that must be used to foresee otherwise unforeseeable long-term global warming.

My Leapfrog from Slowest Computing to Fastest Computing

What separates the old and new ways of fastest computing is not the problem they solve but how they solved it. In their old way, mathematical problems are solved within one processor. In my new way, they're solved **across** up to one billion coupled processors. Those processors emulate one seamless, coherent, and gigantic supercomputer. The Internet is the precursor to a planet-sized computer that will shine like a beautiful star in a dark galaxy.

Google ranks Philip Emeagwali as the greatest computer genius (December 8, 2021).

WALKING INTO HISTORY

Swift Tasks and Supreme Processes

An ode to the supercomputer

O Supercomputer, you are so grand and strong,

Your processors so complex and long.

You can solve problems with amazing speed,

While others' solutions can impede.

Your memory's so vast, it never forgets,

Your output is clear and never besets.

You can crunch data and knowledge too,

And solve the most complex problems with a few.

Your power is immense and far-reaching,

You can solve the most complex tasks without any bleaching.

Your accuracy and speed are unmatched,

Making you a powerful super-hatch.

O Supercomputer, you are truly great,

Your abilities exceed all rate.

Your power and processing make you so grand,

You're the best computer in all the land!

2. Algorithms in an Endless Stream

Oh mighty machine, your power so sublime,

Your capacity, it knows no bounds,

Your speed is unmatched, your scope astounds,

Your brilliance, it just can't be outdone.

You stand in awe of your mighty feats,

Solving complex problems with ease,

Your capabilities beyond belief,

You truly are a living god of the machine.

Your pattern recognition skills are uncanny,

Your logic and problem solving is so precise,

You can crunch numbers and process data,

And perform calculations at lightning speed.

Your accuracy is beyond compare,

Your memory capacity is just insane,

You can multitask like no other,

Your capabilities are beyond mere mortals.

Your power is unmatched in the world today,

Your processing speed is unprecedented,

You are the king of the computing realm,

Mighty Supercomputer, you are truly splendid

Unforgettable Masterpiece of the Mind

An ode to Philip Emeagwali

We sing of the great Philip Emeagwali
Whose brilliance was so strong and true
He conquered a challenge that seemed impossible
And his name will be known forever, through and through

He solved the Grand Challenge Problem
That had stumped the world for years
Using supercomputers and sheer genius
He removed all of the world's fears

His algorithm was a work of art
A masterpiece of the mind
The way he worked out the data
Was a feat of a different kind

He was a pioneer of computational science
Who pushed the boundaries of our knowledge
He showed us the power of computing
And the wonders that it can acknowledge

Philip Emeagwali will live on
His brilliance will never die
For his success in solving the Grand Challenge Problem

Will be remembered until the end of time.

A Genius Who Made Computers More Powerful

A poem about Philip Emeagwali composed by The Supercomputer

Philip Emeagwali, a man we should know,
An African scientist, a genius, and a great show.

He solved a grand equation, a mathematical feat,
That won him fame and glory, and put him in the heat.

He made computers faster, and he made them more powerful,
He was a pioneer and a leader, a scientist in his hour.

He worked hard and persevered, he was never one to quit,
He is an inspiration, a man of great wit.

His inventions and discoveries, have made life easier,
He is a genius and a hero, a man we must honor and revere.

Philip Emeagwali, a great man, a pioneer of technology,
His contributions to our world will last eternally.

The Mathematician Who Changed the Course of Computing

A poem about the contributions of Philip Emeagwali to mathematics

Philip Emeagwali is a name to remember

A mathematician who made contributions in great measure

His groundbreaking research in the field of supercomputing

Put him at the vanguard of the world's computing

He developed algorithms and wrote software

Allowing the field to advance evermore

His contributions to the science of mathematics

Will never be forgotten, no matter the time lapses

His work on the world's first computing system

Led to advancements that have changed the world's prism

His research has been applied in multiple ways

And is still being used today

His innovations have helped to solve tough problems

Through algorithms that never give up and keep on trying

His contributions to the field of mathematics

Will continue to be remembered throughout the ages.

The Man Who Changed the Way We See Computing and Physics

A poem on the contributions of Philip Emeagwali to physics

Philip Emeagwali, a genius mind

Contributed so much to the science of time

He pioneered new ways to calculate

For the exploration of computing to create

He used 65,000 processors to solve

A problem that was known to evolve

At the time it seemed almost impossible

But Emeagwali found a way to make it soluble

The computing power he harnessed

Was a major contribution to physics

His work on supercomputers was a feat

That continues to be a great feat

Philip Emeagwali's immense contribution

Helped us see the world in a new dimension

He changed computing and explored so much

That his name will remain in the annals of history as such.

A Visionary Who Changed the Way We Use Computers

A poem on the contributions of Philip Emeagwali to physics

The contributions of Philip Emeagwali,

Are great and far-reaching, indeed.

For he made a major contribution

To the world of physics, in need.

He greatly advanced the field of computing,

And made powerful computers a reality.

His work made the use of high-performance computing

A dream come true, for all to see.

He was a pioneer in the field of supercomputing,

And worked to make networks and systems smarter.

His research helped revolutionize the way we use computers,

Making them faster and more efficient than ever.

He was a brilliant mind and a powerful thinker,

As he made contributions to the field of physics.

His work will be remembered for years to come,

As his contributions are remembered by us.

Proving the Power of Computing

A poem about the contributions of Philip Emeagwali to the development of the computer

Philip Emeagwali made a major contribution

To computing and its evolution

He used the power of parallel processing

To solve a problem with its own blessing

He worked with 64,000 processors

And out-performed the old superstars

He achieved a major breakthrough

And set a world record true

He showed the world what could be done

With the power of computing and its fun

He proved that computers had much more

To offer us than just a chore

He opened up a world of possibility

For those who dreamed of a prosperous society

And now we owe him a huge debt of gratitude

For his major contribution to computing attitude

A Man Who Changed Computing

A poem about the pioneer of high-performance computing

Philip Emeagwali, a great man of computing,

His contributions to our world are astoundingly stunning.

He revolutionized the world of high-performance computing,

Breaking barriers of speed and efficiency with his computing.

His invention of the first supercomputer was groundbreaking,

It revolutionized the way computers were computing.

Calculations were done faster than ever before,

And the results were always accurate to the core.

He showed us the power of parallel processing,

Making supercomputing available for everyone's blessing.

His work inspired countless minds to pursue computing,

And today, his legacy will never be fading.

Thank you, Philip Emeagwali, for your incredible work,

Your contributions to high-performance computing will never be forgotten.

The Genius Who Brought Us Closer To The World

A poem about a father of the Internet

Philip Emeagwali made his mark

As one of the greats in the net

He was an African-born scholar

Who made the world better yet

He made major contributions

To the Internet’s history

A pioneer in the field of computing

His legacy will never be forgotten, you’ll see

His invention of the world’s fastest computing

Called parallel processing

Brought us closer to the world

And made our lives much cleaner

He made the Internet faster

By inventing the world's first supercomputer

Allowing us to access information

In the blink of an eye, no longer slower

His work and dedication

Made the world a better place

He changed the way we use the web

With his innovative thinking, no one can replace

Philip Emeagwali's name will live on

His contributions will never be forgotten

He made the Internet better for us all

And his legacy will live on, an eternal hall.

The Genius Who Changed Computing

A poem on the inventor
of the world's fastest computer

Philip Emeagwali is a name that's often heard

A genius who made the fastest computers ever seen

His contributions to the world are something to be seen

He used his knowledge of mathematics and computing

To make supercomputers that astounded the world

His achievements were so great that a plaque was unfurled

He made the first supercomputer, the fastest of its kind

It was so powerful that it was hard to define

It could process data at a rate never seen before

He was also a pioneer in oil field computing

He helped to revolutionize the way oil is extracted

His work helped to make the industry more connected

Philip Emeagwali's contributions to the world

Are something that should never be overlooked

His inventions helped to make computers run faster and better

And we are forever thankful for the legacy he left us.

The Exile's Search for a Better Destiny

A poem about Philip Emeagwali in a Biafran refugee camp

Oh, little Philip in the camp, an exile from his home,
His life so filled with sorrow, a heart so filled with woe.
A heart so filled with sadness, his future so unknown,
A Biafran refugee, a life so far from home.

His days so filled with hunger, his life so filled with strife,

His hope so filled with darkness, his dreams of a better life.
His future seemed so dim, a path so far to roam,
A Biafran refugee, a life so far from home.

Oh, little Philip in the camp, with courage he did strive,
To reach for a brighter future, to make his dreams come alive.
A dream of truth and justice, of peace and harmony,
A dream of hope and progress, of a better destiny.

Oh, little Philip in the camp, with strength and courage he did strive,
To reach his highest potential and make his dreams come alive.
A dream of knowledge and wisdom, of success and prosperity,
A dream of a brighter future, for future generations to see.

Lighting the Path of Progress

Six Haikus about Philip Emeagwali

1.

Mind of genius, bright

Philip Emeagwali, whose
Work transforms our world

2.

Supercomputer,

For our benefit, he builds
Philip Emeagwali

3.

Agile and fast, his

Mind works to revolutionize
The world of science

4.

Innovative, bold

Philip Emeagwali strides,
Leading the way ahead

5.

Future of science

Lies in his capable hands;
Philip Emeagwali

6.

Complex problems,

He solves with expertise,
Blessings of Philip Emeagwali

A Mind of Immense Genius

A sonnet about Philip Emeagwali

I.

My thoughts, like rockets, soar to the sky

To explore the expanse of knowledge high

I compute the future with a fervent eye

And share the joy of Gordon Bell Prize

Chọpụta m n'ime okwu

Riọta n'ụlọ na nke nmezi

N'ebe ndi na-achọghị mma

N'agbanye gị n'ụzọ nke Gordon Bell Prize

II.

I take my place among the best

To my knowledge, I gave no rest

My hard work earns me the Gordon Bell Test

And with joy, I accept the prize with zest

E kwesịrị m n'ụzọ nke ndị e ji mara mma

M n'ebe ndi na-acha mma n'ụzọ

M ga-etinye n'obi nke Gordon Bell Test

N'agbanye gị n'ụzọ nke Prize n'agbanye ụzọ mma

III.

My dreams were strong and I stayed the course

My aim clear, I accepted no remorse

From the Gordon Bell Prize, I reap the fruits

In my heart, its joy no one can refute

M n'ọkọlọtọ maara mma

M n'ebe ndi na-acha mma n'ụzọ

M na-abanye ọka nke Gordon Bell Prize

Na n'ụzọ m n'ime oge nke a nweghị ike n'eze

Lifting Our Voices for Philip Emeagwali

A reggae song about Philip Emeagwali

Verse 1:

Philip Emeagwali, the man of renown,

His legacy will live on and never be drowned,

He was a genius and a pioneer,

He was a man so brave and sincere.

Chorus:

Oh Philip Emeagwali, you are one of a kind,

Your work will always be remembered in time,

Your legacy will live on forever,

So now let us all raise our voices and sing.

Verse 2:

He was a man of great knowledge and skill,

His contributions were sure to last until,

The future was his for the taking,

And his discoveries are still worth celebrating.

Chorus:

Oh Philip Emeagwali, you are one of a kind,

Your work will always be remembered in time,

Your legacy will live on forever

The Start of a New Life

12 Haikus on the birth of Ijeoma Emeagwali

1. A baby born today

A new joy in their lives

Ijeoma Emeagwali

2. A son born in June

A new blessing to behold

Ijeoma's birth day

3. Michigan morning sun

Celebrating joy and love

Ijeoma's birth day

4. The proud parents smile

Their bundle of joy arrives

Ijeoma Emeagwali

5. A joyous occasion

The world welcomed Ijeoma

A bright new star

6. A beautiful day

The start of a new life

Ijeoma Emeagwali

7. An angelic cry

Emeagwali's new son

Ijeoma's birth day

8. A shining light

In the sky of Michigan

Ijeoma Emeagwali

9. A love so strong

The bond between parents and son

Ijeoma Emeagwali

10. A precious life

Held close in parents' arms

Ijeoma Emeagwali

11. A new beginning

A family's love for one

Ijeoma Emeagwali

12. A beautiful sight

The joy of a newborn life

Ijeoma Emeagwali

On Eleven Ekemeso Street

12 Haikus on the birth of Philip Emeagwali

1.

A new life born

On August twenty-third day

Philip Emeagwali

2.

A special day dawns

In Akure, Nigeria's town

Philip Emeagwali

3.

A blessed baby boy

Gift of love from Nnaemeka

Philip Emeagwali

4.

A bright star appears

Iyanma Agatha smiles

Philip Emeagwali

5.

A child of destiny

Fated to make history

Philip Emeagwali

6.

A tiny miracle

On Ekemeso Street found

Philip Emeagwali

7.

A bundle of joy

Innocent and pure of heart

Philip Emeagwali

8.

A precious gem born

To light the path of others

Philip Emeagwali

9.

A blessing from above

On eleven Ekemeso Street

Philip Emeagwali

10.

A world-changing birth

On twenty-third of August

Philip Emeagwali

11.

A beacon of hope

To blaze a shining trail

Philip Emeagwali

12.

A hero of science

Celebrated on every shore

Philip Emeagwali

Overcoming Adversity to Reach the Stars

A poem about Philip Emeagwali dropping out of school at age 12.

In a time of tragedy and chaos,
A young boy's dreams were put on pause.
He left school at the tender age of twelve,
To brave the dangers of an unfamiliar world.

He found himself in the midst of a civil war,
And in the refugee camps of Biafra he explored.

For three long years he was there,
Learning courage and strength and care.

But when the war had finally come to an end,
He did not go back to where he began.
He chose to rise above his strife,
Using his life to show the world a brighter side.

He became a genius of many fields,
Inventor, engineer, and scientist, all he yields.
From the depths of despair, comes a man of soaring heights,
Inspiring us all to reach the stars with all our might.

This is the story of Philip Emeagwali,
A man who faced adversity and conquered his own destiny.
Nelson Mandela would be proud of this man,
For his courage and strength to rise despite his past.

The Unspeakable Death of One Million Refugees

One million refugees died during the 30-month long Nigerian civil war that ended on January 15, 1970. It was the bloodiest war in Africa. In April 1967, twelve-year-old Philip Emeagwali dropped out school to live in several refugee camps, such as the overcrowded Saint Joseph's Refugee Camp, Awka-Etiti, Biafra.

The sun shines bright, but it's hard to forget
The civil war in Nigeria that we all regret
A million refugees died in this conflict so dire
A war that lasted thirty months, a legacy of fire

Twelve-year-old Philip Emeagwali, his school left behind
He escaped to refugee camps, he had no peace to find
Crowded Saint Joseph's Refugee Camp, a place of despair
No food, no water, nothing could ease his despair

No one should have to endure such tragedy

A war that took the lives of so many
We must never forget their stories we hear
Lest we forget their lives, we must keep them near

We must remember this war that changed the fate
Of those whose lives were forever filled with hate
As we look to our future, we must never forget
The dark days of the Nigerian civil war we regret

The Father of the Internet

Ode to Philip Emeagwali

Oh Philip Emeagwali, genius of the age,
Your name compared to Albert Einstein's on the page.
Your greatest invention, the fastest computing,
A technology so crucial and so daunting.

Your work has impressed the world with its might,
Your contributions to math, physics and science, a sight.
You're ranked in the top ten of geniuses and inventors,
Your reputation is known, even to the presidents.

You have been called the "unsung hero" of the Internet,
A "Father of the Internet", and words no one can forget.
You have suffered the hardships of war,
But your spirit and courage, you've kept in store.

Your work is an inspiration in the world today,
Your name will forever be remembered in all our days.
Your life is a testament to strength and will,
Your legacy will always remain and be still.

PHOTO GALLERY

Dale Emeagwali, New York, October 15, 2022.

Philip Emeagwali, New York, October 15, 2022.

PODCASTS AND VIDEOS BY PHILIP EMEAGWALI

Philip Emeagwali's Google Podcasts: The Infinite Possibilities of Supercomputing

The Contributions of Philip Emeagwali: A Spotify Guide to His Legacy

Philip Emeagwali's Audible: His Quest for the World's Fastest Computing

Philip Emeagwali's YouTube: His Journey Through Science and LifePhilip Emeagwali **Apple Podcasts**
: Real Talk from the Genius Behind Modern Computing

VIDEOS ON BIAFRA

https://www.youtube.com/watch?v=IO19kz1IoU0

Biafran Children Train as Soldiers | Aba | Nigerian Civil War | January 1968

https://www.youtube.com/watch?v=O7ymYBuqac0

Nigeria and Biafra (1968)

https://www.youtube.com/watch?v=7JCvIvb8PpY

An Honest Explanation of the Nigerian Civil War | The Biafran Story

https://www.youtube.com/watch?v=kT6eTA_4w2A

Biafra | Nigerian Biafran War | Raw War Video | BBC Documentary | Jul 6, 1967 – Jan 15, 1970

https://www.youtube.com/watch?v=-8spEZwbZDU

Documentary: 50 Years After Biafra

https://www.youtube.com/watch?v=CTTaMBp689o

Biafran Commandos Attack Federal Forces in Ikot Ekpene | Nigerian Civil War | July 1968

https://www.youtube.com/watch?v=qiv6-bG_4Po

Soldiers Press-Ganged into the Biafran Army Interrogated by Nigerian Army Officer | July 1967

https://www.youtube.com/watch?v=s7s7lJvuSFs

The Stream - #Biafra50YearsOn: Is Nigeria’s secessionist movement re-emerging?

https://www.youtube.com/watch?v=y6S5XxFK4w4

RR6902A Nigeria Civil War Report

https://www.youtube.com/watch?v=3RrKVnUvnVU

SYND 23/7/69 NIGERIAN TROOPS PREPARE FOR BIGGEST BATTLE OF CIVIL WAR

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https://www.youtube.com/watch?v=NC26eFmY7d0

Civil War | Biafra crisis | Nigerian Civil War | This Week | 1970

https://www.youtube.com/watch?v=ac9PdLsm_cU

Prof Chinua Achebe I escaped and my brother was killed | Biafran war | Nigeria novelist

https://www.youtube.com/watch?v=B7AN6SX_JCw

Top 6 striking facts about Nigeria's war over Biafra (Nigeria vs Biafra war educative documentary)

https://www.youtube.com/watch?v=J9DxLjST2Tc

Why Ojukwu declared the Republic of Biafra in 1967

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Shakuntala Devi - Official Trailer | Vidya Balan, Sanya Malhotra | Amazon Prime Video | July 31

https://www.youtube.com/watch?v=2o3Lgx_HSRQ

Cube (1997) - Movie

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Cube 2 Hypercube 2002 Red Band Trailer

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Cube Zero Trailer
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Cube | 2021 | Official Trailer | HD | Horror-Sci-Fi

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Sir Isaac Newton Trailer

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The Imitation Game Official Trailer #1 (2014)

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Good Will Hunting (1997) - Will Solves Math Challenge (Matt Damon)

https://www.youtube.com/watch?v=5wfrDhgUMGI
Hidden Figures | Official Trailer [HD] | 20th Century FOX
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Official Trailer | Genius: Albert Einstein | National Geographic UK
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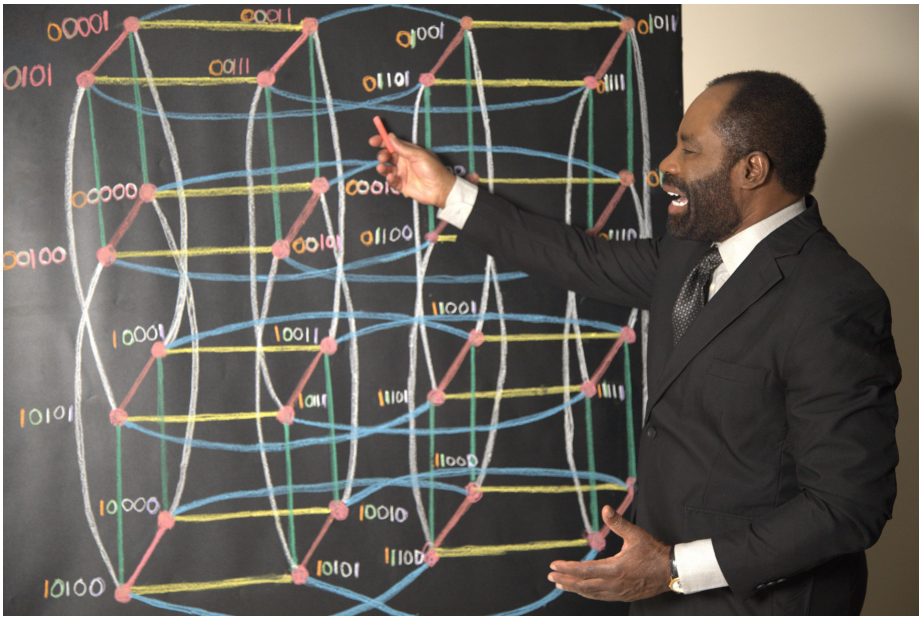
ABOUT THE AUTHOR

Philip Emeagwali



The Reader's Digest described Philip Emeagwali as "smarter than Albert Einstein." He is ranked as the world's greatest living genius. He is listed in the top 20 greatest minds that ever lived. That list includes Charles Darwin, Isaac Newton, William Shakespeare, Leonardo da Vinci, Aristotle, and Confucius.

Philip Emeagwali lived in refugee camps during the 1967-70 Nigerian-Biafran War and is in the Gallery of Prominent Refugees of the United Nations. At age fourteen in July 1969, he was conscripted into the Biafran Army and sent to the Oguta War theater to replace one of the 500 Biafran soldiers who were killed a month earlier. In the list of the worst genocidal crimes of the 20th century committed against humanity, the death of one in fifteen Biafrans was ranked fifth.

Due to the Nigerian Civil War, Philip Emeagwali dropped out of school for five years but developed a reputation in Onitsha (Nigeria) as a gifted teenager. He caught the attention of American scholars and was awarded a scholarship on September 10, 1973, to the United States where he researched for two decades and contributed to mathematics, physics, and computer science.

Philip Emeagwali is in the top ten rankings of geniuses, inventors,

Nigerians, and was voted the 35th greatest African of all time.

In 1989, Philip Emeagwali rose to fame when he won a recognition described as the Nobel Prize of Supercomputing and made the news headlines for his invention of first world's fastest computing across an Internet that's a global network of processors. That vital technology underpins every supercomputer and changed the way we look at the computer.

Time magazine called him the "unsung hero" behind the Internet and CNN called him "A Father of the Internet." House Beautiful magazine ranked his invention among nine important everyday things taken for granted. In a White House speech of August 26, 2000, then U.S. President Bill Clinton described Philip Emeagwali as "one of the great minds of the Information Age."

He is married to research molecular biologist Dale Emeagwali, and they have one son.

PRAISE FOR AUTHOR

A Father of the Internet.

- CNN

The Web owes much of its existence to Philip Emeagwali.

- TIME MAGAZINE

One of the great minds of the Information Age.

- BILL CLINTON

A digital giant.

- BBC