

Emeagwali's **Internet of the Future** Hailed as "Utterly Wondrous, Yet Frightening"

Listen to the radio advertisement for Emeagwali's lecture

<http://www.youtube.com/watch?v=vPGtUABfLMI>

On June 8, 2008, Philip Emeagwali presented to Trinbagonians a poetic lecture which took place at the flagship institution of learning of the Caribbean – The University of the West Indies. He took the audience on a fascinating journey of the interconnectivity between humanity and the Internet and revealed his vision of how "the Internet, as we know it, will become obsolete and disappear into our collective memory," as well as using the metaphor of the Internet as "our shared planet-sized supercomputer." His futuristic lecture generated a buzz on the Net with *Dissident Voice* hailing it as "utterly wondrous, yet frightening in its ultimate disconnect." The Nigerian Ambassador praised the fluid delivery of his lovely lyrical lecture and summed it up as "a good day to be a Nigerian."



Emeagwali spoke before this capacity crowd of 500 at the John F. Kennedy Auditorium of The University of the West Indies, Trinidad and Tobago.

Behind the Internet

Computer genius thrills at Emancipation lecture series

June 11th 2008

(TrinidadExpress.com)

Comment: http://www.trinidadexpress.com/index.pl/article_features?id=161337065

Dr Philip Emeagwali takes us from the blackboard to the drawing board to the motherboard and then to what he considers as the mother of all motherboards-the super computer. A mind which engineered the linking of 65336 electronic processors, to be able to compute 3.1 billions calculations per second using physics, mathematics and computing, and won the Gordon Bell Prize in 1989, (considered the Nobel Prize of computing), was last in class at the age of five and has been a child soldier in Nigeria during a vicious war. Called by President Bill Clinton, "one of the great minds of the Information Age.", Dr Emeagwali has certainly overcome some grand challenges to achieve significant milestones in his lifetime.

Dr Emeagwali was the guest of the Emancipation Support Committee (ESC) for the launch of the Kwame Ture Memorial Lecture Series 2008 last Sunday at the University of the West Indies. "It is truly a privilege to have someone of Dr Emeagwali's stature in our midst," said Tracy Wilson, Chairman of the Education Committee, ESC. "We continue to seek out speakers and thinkers who can share a different paradigm of thought. Persons, who by their experiences can give our younger generation some hope for their future. Dr Emeagwali is undoubtedly an inspirational speaker, and his presentation marked the beginning of what the

Emancipation Support Committee expects to be its most stimulating and enlightening lecture series yet."

Noted as the "Bill Gates of Africa", Emeagwali spoke on this year's theme 'Crossing New Frontiers to Conquer New Challenges,' having risen from humble beginnings in Akure, Nigeria, to become the individual TIME magazine recognised as the 'unsung hero of the Internet,' for his contributions to Super Computing. Dr Emeagwali grew up in Nigeria during a time of war and turbulence that forced him to drop out of school, yet he was still able to complete his education abroad, receiving a general education certificate from the University of London and later degrees from George Washington University and the University of Maryland. He also studied in the doctoral fellowship programme at the University of Michigan.

At the launch of the Kwame Ture Memorial Lecture Series, at the JFK Lecture Theatre, a capacity 500-strong audience listened attentively as Dr Emeagwali painted a picture of the internet from the moon, "Just picture the Internet as an electronic web over the earth, the 8th continent, with millions of twinkling points, a feast for the eyes and the mind."

Asked what was the transforming moment in his life-Dr Emeagwali stated, "When I was 5 years old, my father recognised that I was slow in Math, he worked with me, pushing me until eventually I could do 100 questions in an hour. His efforts pushed me beyond my comfort zone. Parents must set higher standards for their children and push them beyond their comfort zone. We must remember that every genius is an ordinary person who did

extraordinary things." His prowess in mathematics earned him the nickname "Calculus" at University.

Asked about his experiences as a black man in the white-dominated area of computing and mathematics-Dr Emeagwali recounted the fact that in the early days he often had to deny his blackness, and to be accommodating to everyone, just to fit in. However, because of his blackness-he was forced to work alone, and it is this work that has brought him international success and recognition. He also tells the story of an artist preparing a sketch of him for a publication using his features, but portraying him as a white man. "We must never allow others to project their image of us, on us. We must maintain our own identity."

"Emancipation means for me, not just a freeing of the body-but also of the mind, we must be at the edge of knowledge in all our fields. We can not be fully emancipated if we lack intellectual capital. Five thousand years ago Africa was the intellectual capital of the World, with the pyramids, science and Math, we must regain that position by being more conscious, by investing more in education and by understanding our past."

"In the past men fought with swords and bayonets, today you must be equally armed, not with weapons but with knowledge and new techniques to achieve our own emancipation."

The Kwame Ture Lecture Series continues with another free lecture by lecturer, economist, columnist; Dennis Pantin on the topic Capitalism and the destruction of the Environment; New Challenges to Human Survival and Development at the National Museum Annex,

Fredrick Street, Port of Spain from 7 p.m. tomorrow. For further information call the Emancipation Secretariat at 628-5008.

Beyond the Last Computer

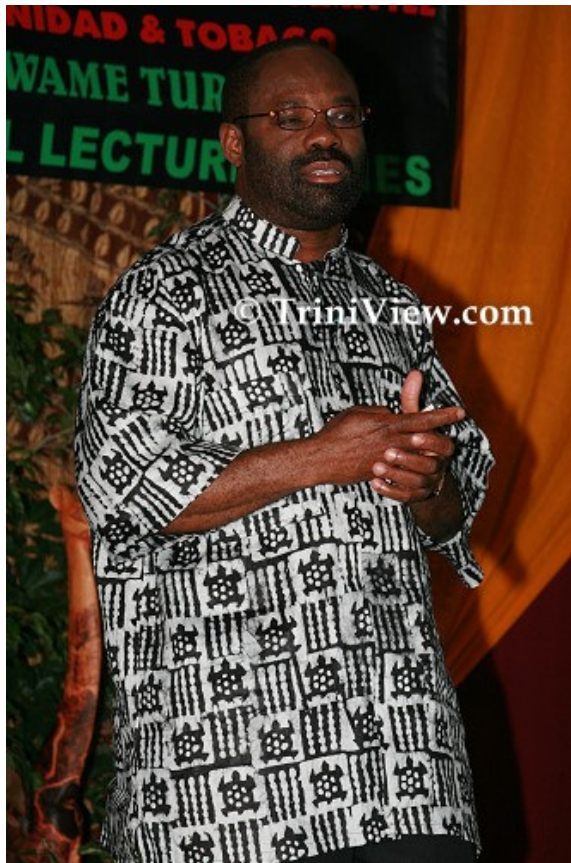
by Philip Emeagwali

emeagwali.com

I thank the Emancipation Support Committee for inviting me to Port-of-Spain, Trinidad to deliver the Kwame Ture (Stokely Carmichael) Memorial Lecture. Stokely Carmichael crossed new frontiers to conquer the civil rights challenges of the 20th century.

As we heed Kwame Ture's call, and march together across the world stage, let us never forget that we are the torchbearers of his legacy of fighting for the emancipation of Africans at home and in the Diaspora.

It is a privilege to be invited to The University of the West Indies in Trinidad to share my thoughts on how to cross the technological frontier and conquer the grand challenges of the 21st century.



Walk with me down memory lane. The time: 39 years ago. The place: the bank of the River Niger in Nigeria, West Africa.

I felt the hard, cold steel of a gun against the back of my head. I spun around and saw my assailant's finger shaking on the trigger: "Don't run or I'll shoot you," he said. I was just 14 years old, and death was a stranger to me.

It was 1969, and Nigeria was embroiled in civil war. As a teenage refugee conscripted into the Biafran Army, I was forced at gunpoint to carry weapons to the Oguta front. It was a 24-hour, march through mosquito-infested mangroves flooded by the River

Comment: Excerpt from "Surviving in Biafra" by Alfred Obiora Uzokwe (page 78)

"Young boys no longer had the freedom to roam the villages, because they would immediately be taken away and sent to war.

"A typical conscription exercise consisted of three or four soldiers, armed to the teeth, suddenly swooping onto the village. They would then disperse and while some went from house to house in search of men of army age, others would hang outside the compounds, hoping to catch those attempting to escape...

"they [soldiers] would chase the person and then threaten him with orders like, "If you move, I go shoot.

"A cousin of mine, a barrister, was conscripted on his wedding day ... The soldiers simply went to the high table, took the groom, who was resplendently dressed in his wedding suit, and left.

Niger.

When the 30-month war ended on January 15, 1970, I was discharged and reunited with my parents. Together with one million returning refugees we walked for three days, avoiding landmines along fetid rainforest footpaths. Eventually, we reached our hometown of Onitsha. It was badly battered by the war.



Comment: Upon sighting Emeagwali, the High Commissioner from Nigeria to Trinidad and Tobago [left] exclaimed in Igbo "*I bukwa oke Mmanwu*" ["You're a Great Spirit"].

There my thoughts returned to a love abandoned three years earlier—mathematical physics. This love affair blossomed when I was a refugee in Biafra, —shortly before July 20, 1969—the day man first walked on the moon. While running an errand, I stopped to gaze through a classroom window and saw a physics lecturer writing on a blackboard. It was Newton's Second Law of Motion: "Force equals mass times acceleration, or $F=ma$."

Unaware that I had just been introduced to the most important law in physics, I was, nevertheless, awestruck. Newton's Second Law of

Motion is far more important than Einstein's Theory of Relativity. "E equals MC squared" may be sexier on a T-shirt than " $F=ma$," but *Encarta* lists the three laws of motion as the third most important scientific discovery of all time.

Three hundred and thirty years later, we still do not completely understand $F=ma$. But it is the only formula that is integral to computing's 20 grand challenges and mathematics' seven millennium problems. I devoted many years devising a solution to one grand challenge. While conventional wisdom suggested it would be almost impossible to harness the power of 65,536 processors my grand challenge was to prove otherwise.

Initially, the challenge seemed deceptively simple; but in reality, there were so many different tiers of complexity that I sometimes forgot why I was programming those 65,536 processors. In hindsight, I did just about everything wrong before I finally got it right. Research is a high-risk game, but, as they say, nothing ventured, nothing gained.



The complexity of the grand challenge renders it as incomprehensible to laypeople as pages of hieroglyphics or Greek symbols. Concisely, the challenge used the Second Law of Motion propagated along a virtual 16-dimensional hypercubic network to be executed by 65,536 processors. These processors are the beginning of the end. I started at the end because the end is devoid of the complex proofs and dense mathematical language that are unfathomable to non-mathematicians.

This grand challenge earned its name: it was a super problem that required one to think in ways that merge the laws of physics, logic, and numbers in 16-dimensional mathematical space, and to solve the problem by attacking it from three perspectives.

Walk with me as I tell a story that will take you from the Second Law of Motion to the blackboard, to the motherboard, to the mother of all motherboards: a one-of-a-kind computer powered by 65,536 processors. Every scientific discovery begins as a thought.

The strategy for harnessing these laws of physics, logic, and numbers has to be conceived and thought out before becoming reality.

I visualized the grand challenge problem as a complex game with complex parameters, which I solved using three simple rules. First, I harnessed the power of processors to perform myriad computations. Second, I followed a minimum number of communication pathways to perform a minimum number of communications. Third, I enforced the Second Law of Motion in models of all that flows underneath the Earth.

In all, I had 65,536 processors and over one million pathways. The processors-plus-pathways make a computer a supercomputer, and a planet-sized supercomputer an Internet.

I have been asked: “What gave you the confidence to tackle one of computing’s grand challenges?” My answer — fifteen years of putting into practice the athlete’s five **P** mantra: **P**roper **P**reparation **P**revents **P**oor **P**erformance.

In the 1980s, I was a mathematical physicist logged on 24/7 to a 65,536-brain supercomputer on think.com —the third registered dot com ever. It was an unpaid labor of love. I was tormented by self-doubt, a maniac who pushed his supercomputer to its breaking point.

Each one of us must learn to move outside our comfort zones. We learn with each step we take into the unknown. When I was five, my father discovered that I was slow in mathematics. He decided to teach me to solve 100 math problems in one hour. Thereafter,

my ability to do rapid calculations earned me the nickname “Calculus” and set me on the path to become a supercomputer scientist who solved one of the most difficult problems in mathematics.

My father helped propel me beyond my comfort zone. His child, once considered slow at mathematics, is now making his living by performing the fastest calculations ever seen. My father created strength from my limitations by recognizing and acknowledging them, and by challenging me to remove myself from my comfort zone.

My father did not help me conquer my fear of math. Instead, he attempted to reveal my individual potential, something that every child has but few parents take the time to help develop. If you are looking for a “child genius,” keep looking ... every genius is an ordinary person who accomplished an extraordinary thing. Your child has more talent than you know, and if you realize that fact, you will raise a genius!

What if my father had allowed me to run away from math? I would have been math “illiterate.” If my father had not acknowledged my mathematical limitations, I would not have become a mathematician who solved one of the grand challenges.

The Emancipation Support Committee asked me: What are tomorrow’s grand challenges? How do we cross technological frontiers to conquer tomorrow’s grand challenges?

Crossing the frontiers of knowledge to conquer tomorrow's grand challenges will demand revolutionary techniques. To solve this problem, I used the American Revolutionary War as a metaphor for what happens when a revolutionary technique is introduced to support a revolutionary technology.

In the 18th century, people fought with swords, by lining up and charging one another. When long rifles — with short swords called bayonets — were invented, armies continued their conventional fighting format: lining up in opposing lines and mowing each other down with gunfire.

Many lives later, they realized that a new fighting technique must follow the new gun technology. Kwame Ture, Stokely Carmichael, realized that a new fighting technique must be used to gain our political emancipation.

The same can be applied to your personal and professional lives. At the crucial moments, the turning points, in your career and life - marriage, birth and death - you may have to change your approach, find new techniques.

In my new technique, my 65,536 processors perform computations side by side, linked by 16 wires, each corresponding to the 16 sides of a 16-dimensional hypercube. This is the essence of "higher" mathematics: go beyond calculus and mine infinite dimensional spaces.

My multicolored drawings of the hypercube are a feast for the eye; programming them is a feast for the mind. The hypercubic circuitry of the supercomputer left me breathless. I was awestruck by its 16

unique information pathways coming from each processing node. Has there ever been any technology as gorgeously complicated as the hypercube supercomputer?

For me, it was love at first sight. It was hypercubic elegance that engaged me emotionally, imaginatively and computationally.

I was asked: Where is the frontier of the Internet? Today, the Internet is being reinvented as the eighth continent - it is our 21st-century frontier, our terra incognita, an electronic canopy, a borderless community, a virtual landmass. Our image of the future inspires the present, and the present creates the future.

Today's supercomputer will become the ordinary computer of tomorrow, while the Internet becomes our shared planet-sized supercomputer.

One day, the Internet will become our shared planet-sized supercomputer and individuals will become nodes on the Internet and the Internet, as we know it, will become obsolete and "disappear" into our collective memory.

By definition, both the supercomputer and the Internet consist of connected nodes working in harmony. In fact, the supercomputer is more about communication than computation. The supercomputer and the Internet link computation and communication into a congruent whole - two complementary sides of a coin.

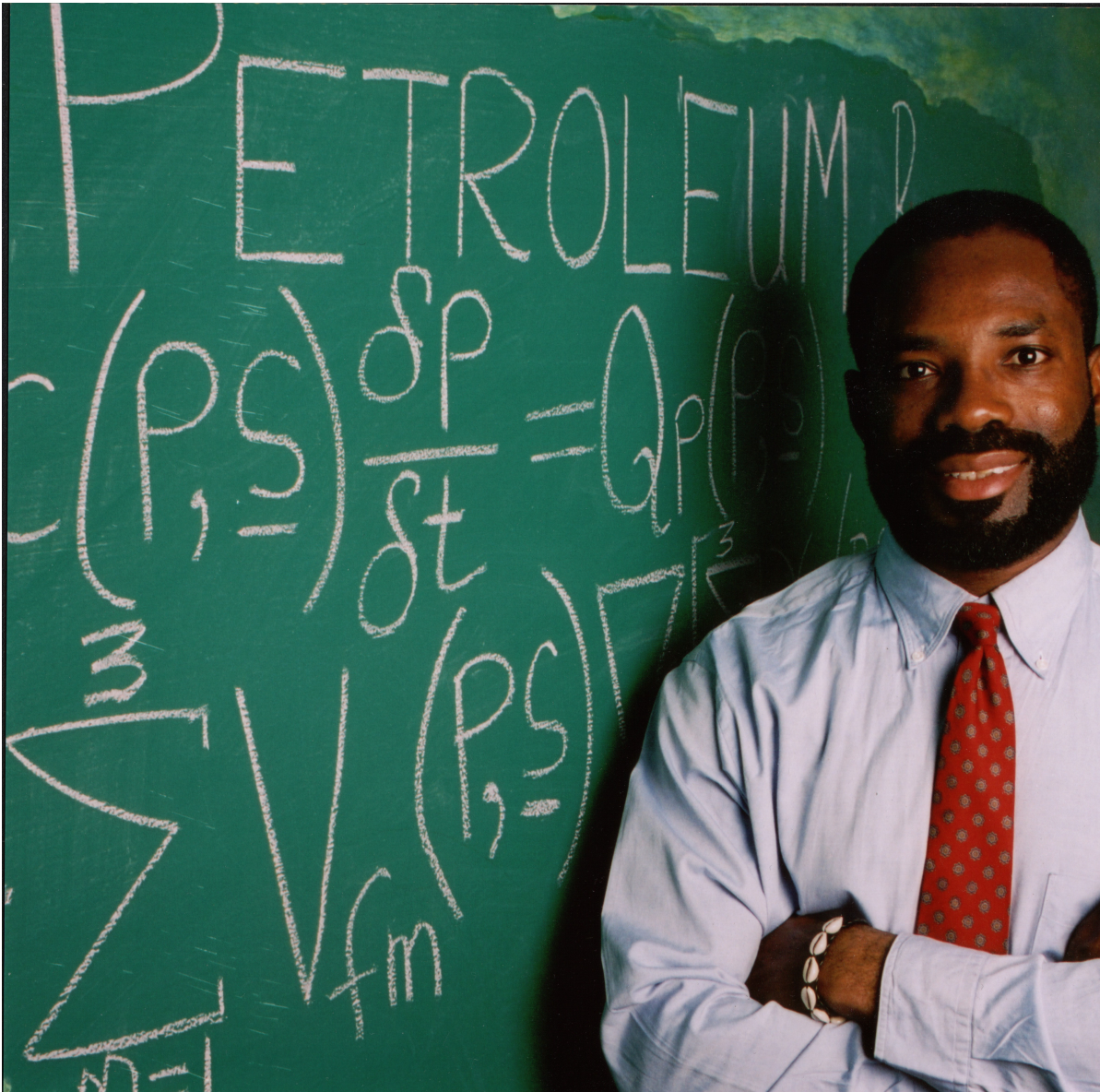
As the computer evolves into the supercomputer, and the supercomputer evolves into the Internet, and the Internet evolves

into humanity, all that will remain will be a HyperBall superbrain — an electronic, organic Web 10,000 miles in diameter encompassing the Earth. The nodes will be people, embedded in an interconnected network of humanity working as one.

If history repeats itself, the supercomputer of today will become the ordinary computer of tomorrow. This core technology could evolve to become iconic, a masterpiece, a legacy, a legend, and a contribution to civilization. Each new “grand challenge” met becomes another beacon guiding humanity forward into the age of information.

Excerpted from a **lecture** delivered by Philip Emeagwali at the University of the West Indies, Trinidad and Tobago on June 8, 2008. The entire transcript and video are posted at emeagwali.com.

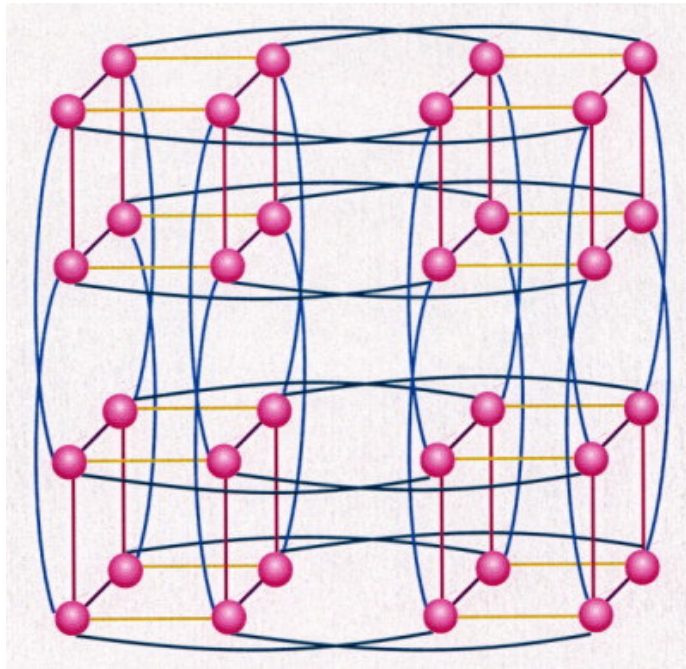
Philip Emeagwali has been called “a father of the Internet” by *CNN* and *TIME*, and extolled as “one of the great minds of the Information Age” by former U.S. President Bill Clinton . He won the 1989 Gordon Bell Prize, the Nobel prize of supercomputing.



“The complexity of the grand challenge renders it as incomprehensible to lay people as pages of hieroglyphics or Greek symbols,” declared **Philip Emeagwali**

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A 32-node extract from a 65,536-node hypercubic processors-plus-pathways. “My multicolored drawings of the hypercube are a feast for the eye,” says Philip Emeagwali.

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