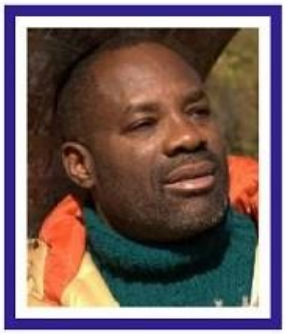

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Philip Emeagwali Lecture
Visit http://emeagwali.com for complete transcripts of 100+ lectures.
Video: https://YouTube.com/emeagwali
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9 What is Philip Emeagwali Famous For?

9.1.1.1 The Hero's Quest

At 8:15 on the morning
of the Fourth of July 1989,
the U.S. Independence Day,
I saw something

that had never been seen before.
By seeing something
where nothing existed,
the discoverers and inventors
made darkness visible.
The inventor
embarked upon a hero's quest
to hear something
that was previously unheard;
to see something
that was previously unseen;
and to understand something
that was previously misunderstood.
Trying to understand an invention
without the life story of its inventor
is like looking at an embroidery
from the wrong side of the cloth.

9.1.1.2 The Eureka Moment!

On that U.S. Independence Day,
in Los Alamos, New Mexico, United States,
I made the first experimental measurement
of the world's fastest computation
ever recorded **across**
an ensemble of processors
that is a new internet.
That invention
represents a new way
of looking at the computer.
To be the first
is a greater achievement
than to be number one
or to be the fastest.
There's only one first
but they will be many fastest.
I was the first to discover that
parallel processing **across**

an ensemble of the slowest processors
is faster than sequentially processing
only on the fastest processor,
or doing so only on the fastest supercomputer.
Back in 1989,
it was my most pleasurable experience
to be the first-person-ever
to stand at the farthest frontier
of human knowledge
and see
the massively parallel processing
supercomputer
that is the precursor
to the modern computer.
On the night of the Fourth of July 1989,
I had a powerful, unsettling dream.
I woke up with the visceral feeling
that I had permanently entered

into the history book
and into school reports.

9.1.1.3 Philip Emeagwali Invention

I witnessed the birth cry
of a new computer
that is a new supercomputer
that is a new internet
that is outlined
as a new global network of
65,536 tightly-coupled processors
that were identical and equal distances apart.
Each processor operates
its own operating system.
Each processor
has its own dedicated memory
that shares nothing with each other.
I trembled because I saw a supercomputer
that no human had ever seen before.

I saw an ensemble
of the slowest processors
in the world
outperform the fastest supercomputer
in the world.
I got goose bumps
and my hairs stood on end
while I watched my invention unfold.
Seeing, for the first time ever,
the **slowest** processors compute together
to compute faster than
the **fastest** supercomputer
was the most amazing experience
in my life.

9.1.1.4 The Paradigm Shift

I trembled because I was witnessing
the birth of a new era

in the history of the computer.
I trembled because I was witnessing
a paradigm shift
in the supercomputer world.
I trembled because I was witnessing
a change of tectonic proportions
that will forever affect the way
our distant descendants of Year Million
will think about their version of the computer.
I trembled because my dreams
and my illusions had become reality.
I got goose bumps because
I was gazing **across** the centuries
and into one thousand millennia.
That Fourth of July 1989
marked the moment
we changed the way we looked at
the modern supercomputer
and changed the technology

from an old computer
that computed with only one electronic brain
to a never-before-seen supercomputer
that executes the fastest computations
and compute them **across**
a never-before-seen internet
that was outlined by millions upon millions
of electronic brains.
That Fourth of July 1989
marked the moment
when for the first time ever
an ensemble of the slowest processors
computed together
and computed as one seamless, cohesive unit
and computed faster than
the fastest supercomputer.
For me, Philip Emeagwali,
that Fourth of July 1989
was a day of fire,

the day the massively parallel processing
supercomputer
became the fire we can't put out.
After my discovery on that day,
trying to stop the acceptance of
the massively parallel processing
supercomputer
became like trying to stop midnight.
I experimentally discovered
that using only one processor
to solve the toughest problems
arising in extreme-scale
computational physics
was like putting the wings
of a jet aircraft
upon an ocean liner.
My **paradigm shift**
was from computing in the singular

to both simultaneously computing
and communicating
in the plural senses.

9.1.1.5 Benefits of Philip Emeagwali Supercomputer

The need to calculate
is as old as humanity.
The need to compute
existed because it is central to
human existence.
On the Fourth of July 1989,
I witnessed the unveiling
to the human race
of a new understanding of the words '**computer**'
and '**supercomputer**.'
As an aside, the Latin equivalence
of the word "computer"
was first used in print

two thousand years ago.
The word “computer”
was first used by the Roman author
Pliny the Elder.
The word “supercomputer”
was coined in 1967.
I believe that our children’s children
will coin a new word
for their supercomputers.
I believe that our children’s children
will invent supercomputers
that are science fiction to us.
I discovered that
inventing a new technology
creates a need for a new vocabulary
and a new narrative
for the histories of science
and technology.

10 Thunder Road to Biafra

10.1 Introduction

10.1.1 Gazing Across 1,000 Millennia

The invention
of the massively parallel processing
supercomputer
is the single most transformative technology
and the biggest advance in physics
since Newton, Galileo.
The computer is integral
to human civilization.
The computer
is the greatest invention
of the 20th century.
Parallel processing
is the biggest advance

in the history of the computer.
We have changed
the way we think about the computer,
from computing with only one processor
to supercomputing **across**
millions upon millions of processors.

10.1.2 Philip Emeagwali Supercomputer

Back in 1990,
I made headlines
in major U.S. newspapers because
I had invented something new
—namely, a new internet
that is a new supercomputer *de facto*
but that is not a new computer *per se*.
That internet
could have been invented earlier
but was not.

Fire is man's first invention,
or rather man's first discovery.
The computer is the greatest invention
since fire was discovered.
The modern supercomputer
is the greatest invention
in modern physics.
The computer was invented
not because
we did not know how to compute.
The computer was invented
because we needed to compute faster,
and sometimes to compute infinitely fast.
And the supercomputer
is the fastest computer.
The modern supercomputer
is a tool
that enables the mind
to go where the eyes cannot see.
To invent a never-before-seen

supercomputer
is to turn **fiction** into **fact**
and do so by computing at
unheard of speeds
and supercomputing to solve
grand challenge problems
arising in extreme-scale
computational physics
and that were otherwise impossible
to solve
on existing supercomputers.
That was the reason
I was in the news headlines
back in 1989.

10.1.3 A Child Soldier's Story

I'm **Philip Emeagwali**,
a child soldier
on the Biafran side
of the Nigeria Biafra War,
a war that raged
during the last 30 months
of the 1960s,
a war that was described as
Africa's bloodiest war,
and a war
in which one in fifteen Biafrans died.
My twenty-year long journey
began at a war front
in July 1969
and ended at the frontier of knowledge.
The turning point in my journey
to the frontier
of the most massively
parallel processing supercomputer

occurred twenty years
before my experimental discovery
of the massively parallel processing
supercomputer
that, in turn, occurred
on the Fourth of July 1989
in Los Alamos, New Mexico,
United States.
In July 1969, I was **conscripted**
as a 14-year-old soldier
and sent to the Oguta War Front,
Igbo Land, Biafra, West Africa.
I was the youngest soldier there.
That war
turned my ancestral homeland
into Africa's bloodiest battlefield.
I arrived at the Oguta War Front
a few days after
500 Biafran soldiers
fell dead on the ground.
Five hundred soldiers fell

as if they were dry leaves.
I was conscripted
to replace
one of these 500 men.
At the Oguta War Front of Biafra,
they were more guns
than pens.
That 30-month-long war
ended on July 15, 1970
with the defeat of Biafra.

10.1.4 Chronicles From Biafran Refugee Camps

A twelve-year old
writing her school report
asked for a little known fact
about **Philip Emeagwali**.
I asked her:
What else does **Philip Emeagwali**

have in common
with the German-born
theoretical physicist Albert Einstein
or with the South Sudanese-born
supermodel Alek Wek
or with the South African-born
singer Miriam Makeba
or with the South African-born
novelist Nadine Gordimer
or with the Haitian-born
former Governor General of Canada
Michaëlle Jean?
The answer is that we were all
former refugees
who were featured in a school poster.
That school poster was titled:
"Refugees You May Know."
Because of that refugee poster

I received letters from Somali refugees
in Kenya, from refugees
from the Democratic Republic of Congo,
from refugees in Ethiopia,
from refugees in Burundi, Rwanda,
and Liberia.
That refugee poster
was produced and distributed
by the United Nations.
According to the United Nations,
65 million persecuted people
were forced to flee from their homes
and forced to flee from civil wars
and forced to flee from areas
that were afflicted
with severe food shortages.
For three years of the late 1960s,
I was a refugee in Biafra

who mostly lived in classrooms
that were converted into living rooms.
For three years,
all schools in Biafra
were closed and converted into
makeshift, overcrowded housing,
and feeding centers
for millions upon millions
of Biafran refugees.

10.1.5 One Day We Had to Run!

In early 1968, Russian MiG 17s
—the same high-subsonic fighter aircrafts
that were heavily used in Vietnam—
and Russian Ilyushin 28s bombers
paid us regular visits
in Onitsha (Biafra).
From the Inland Town quarters,
Enu Onicha, of Onitsha

and on Wednesday March 20, 1968
we saw Biafran soldiers
fleeing on foot from Abagana War Front.
Abagana was a five-hour walk
from our residence.
It was from fleeing Biafran soldiers
that we learned that
my ancestral hometown of Onitsha (Nigeria)
would be captured in six hours.
We knew the Nigerian army
did not take prisoners.
We had learned from the "Dance of Death"
of October 7, 1967 in Asaba (Nigeria)
that 700 unarmed civilian men
were murdered.
So we knew to flee immediately.
We fled from 14 Mba Road, Umudei Village,
Onitsha (Biafra),
the residence of my uncle John Emeagwali,
to Merchants of Light School, Oba (Biafra).
That flight from Onitsha
was the last time
I saw John Emeagwali's residence

that was at 14 Mba Road, Onitsha.
That residence
that was built six years earlier
was ground zeroed
by either a bomb or a rocket or a cannon
fired by the Nigerian Army.

Please allow me to quote
from another eyewitness account
what happened in Onitsha (Biafra)
on the night we fled.
This eyewitness account was titled:

"Nightmare in Biafra."

This eyewitness account
of the night of March 20, 1968
that we fled Onitsha (Biafra)
appeared in the "Sunday Times"
of London [England]
on page 12 April 26, 1968.

[And I quote]
"I have seen things in Biafra this week
which no man should have to see.
Sights to search the heart
and sicken the conscience.
I have seen children roasted alive,
young girls torn in two by shrapnel,
pregnant women eviscerated,
and old men blown to fragments.
I have seen these things
and I have seen their cause:
high-flying Russian Ilyushin jets
operated by Federal Nigeria,
dropping their bombs
on civilian centres throughout Biafra.
[End of quote]

The war correspondent
who wrote the article
"Nightmare in Biafra"
continued:

[And I quote]
“At Onitsha,
under siege from the federal troops,
the three-hundred-strong congregation
of the Apostolic Church
decided to stay on
while others fled
and to pray for deliverance.
Col. Mohammed's Second Division
found them in the church,
dragged them out,
tied their hands behind their backs
and executed them.”
[End of quote]

10.2 How I Invented a New Supercomputer

10.2.1 Philip Emeagwali Origin Story

My ancestral origin
is from the Igbo-speaking people
of southeastern region of Nigeria.
According to an Igbo proverb:

[quote]
"A new fowl, in a new land,
looks at the old fowls
to learn how to crow
in their new language."
[unquote]

I—**Philip Emeagwali**—was the new fowl
in the then unknown land

of the modern supercomputer.
I was the new fowl
in massively parallel processing
supercomputing
who did not look at the old fowls
in vector processing supercomputing.
I did not learn from the old fowls
how to invent
a never-before-seen internet
that is a new supercomputer *de facto*
but that is not a computer *per se*.

10.2.2 My Quest for the Fastest Supercomputer

Parallel processing was scorned
as a beautiful theory
that lacked experimental confirmation.
I began supercomputing

when I was only nineteen years old.
I began supercomputing
at 1800 SW Campus Way,
Corvallis, Oregon, United States.
When I began supercomputing,
I was new in the United States,
having arrived on March 24, 1974
after receiving a scholarship letter
that was dated September 10, 1973.

10.2.3 Who Is It that Can Tell Me Who I Am?

Who is it
that can tell me
who I am?
I am **Philip Emeagwali**,
born on August 23, 1954
in Akure, to Igbo parents
who were living in the heart of Yoruba Land.

I was born
in the then British West African colony
of Nigeria.
In a sense, my story began
in the faraway United States
seven years before I was born
in the August 25, 1947 issue
of *The New York Times*
that carried an article titled:

"New Giant 'Brain' Does Wizard Work."

That *New York Times* article explained that:

e New York Times

IN NEW YORK

NEW GIANT 'BRAIN' DOES WIZARD WORK

Bureau of Standards Says It Can Solve Vast Mathematical Problems in a Few Minutes

LABORATORY FOR THIS CITY

Others to Be Set Elsewhe

[And I quote]
“...the machines under construction
will have a ‘built-in intelligence’
which will enable them to handle
the most complicated differential equations
of physics and engineering,
performing hundreds of
separate mathematical operations
without the intervention
of a human operator...”
[unquote]

Forty-three years
after that big question
was posed in *The New York Times*,
I solved the problem
that was listed
by the United States government
as one of the twenty grand challenges
in supercomputing.

For that breakthrough,
I was in major U.S. newspapers,
such as in the June 20, 1990 issue
of the *Wall Street Journal*.
I was in the news because
my invention
of the massively parallel processing
supercomputer
that occurred on the Fourth of July 1989
was an invention
of a new supercomputer
with 'built-in intelligence,'
that solves the toughest
partial differential equations
arising in physics,
or in extreme-scale
computational fluid dynamics.
The poster boy
of these grand challenge problems
is the general circulation model
that must be used to foresee

otherwise unforeseeable climate changes.
I was in the news because
of my invention
of how to send and receive
64 binary thousand email messages
and how to do so **across**
my ensemble of 65,536
tightly-coupled processors.
I was in the news because
of my invention
of how to perform the world's fastest
supercomputer calculations
ever recorded
and how to always record
a world record speed in supercomputing
and how to do so **across**
a new global network of processors
that is a new internet
and a new supercomputer
and a new computer.
A discovery or an invention

is like the moon.
It has two parts:
the **visible** part and the **hidden** part.
For that reason, **I am well known**
but I am not known well.

10.3 From Soldier to Scientist

10.3.1 My Discovery of the Fastest Supercomputer

A 12-year-old asked me:

"I'm doing a school report
on the development of the computer.
Why are you called
the **father**
of the modern computer
that solves many problems **at once**?"

I answered:

“The computer
has many fathers and mothers,
uncles and aunts.
But I am the only father
of the computer
who was profiled
in major U.S. newspapers
and who was credited
for the invention
of the massively parallel processing
supercomputer.”
I was in major U.S. newspapers
because I made the first
experimental measurement
of the world’s fastest computation
ever recorded **across**

an ensemble of the slowest processors
in the world.

10.3.2 Why I Was in the Newspapers

The reason my invention
of the massively parallel processing
supercomputer
was written about in major U.S.
newspapers
was that it opened the door
for speeding up **30,000 years**
of **time-to-solution**
on one computer
that computed
with only one processor
to just one day of **time-to-solution**
on one supercomputer
that simultaneously computed **across**

a tightly-coupled
ensemble of ten million processors.
At its core primordial essence,
my quest
for a never-before-seen supercomputer
aimed to change the way
we solve the toughest problems
arising in calculus and algebra
and to change that way
from solving the toughest problems
on only one computer
powered by only one processor
that is not a member
of an ensemble of processors
to solving the toughest problems
across millions upon millions
of tightly-coupled
commodity-off-the-shelf processors
that shared nothing between each other.

10.4 Who Is It that Can Tell Me I'm Mad

10.4.1 My Struggles to Invent the Supercomputer

Asking a person to become
the **first** programmer
of the **first** massively parallel
processing supercomputer
was like asking a man
who had never climbed a mountain
to climb Mount Everest.

Because it was considered impossible,
back in the 1970s and '80s,
to program the first
massively parallel processing
supercomputer
nobody took me seriously

in my solo attempt
to climb the Mount Everest
of the world of supercomputers.
In my fifteen years of supercomputing,
onward of June 20, 1974,
I made mistakes
but I was open
to quick course corrections.
Those corrections
took me to the unknown world
of massively parallel process**ing** **across**
a new internet
that is a small copy
of the global internet
that encircles the Earth.
My new internet
is a new global network of
64 binary thousand
tightly-coupled processors.
Each processor

has its own operating system.
Each processor
has its own dedicated memory
that shares nothing with each other.

10.4.2 Before and After My Discovery

Before my **invention**
of the massively parallel processing
supercomputer
that occurred
on the Fourth of July 1989,
the word "supercomputer"
referred to a supercomputing machinery
that is powered by only one
central processing unit.
After my **invention,**
the word "supercomputer"
referred to a supercomputing machinery

that is powered by up to
ten binary million
central processing units.

10.4.3 Philip Emeagwali Invention

I am the first person to discover
the fastest computations **across**
the slowest processors.
Since my 1989 invention
of the massively parallel processing
supercomputer,
I felt like the ancient mariner
who travelled around the world
to tell his story and give lectures
to different people.
My **invention**
of the massively parallel processing
supercomputer

that is a new internet
enabled me to compress
180 years of **time-to-solution**
on only one processor
and to compress that time
to just one day of **time-to-solution**
across my new internet
that is my new global network of
64 binary thousand
processors
that computed in parallel.
I invented
how to solve
grand challenge problems
arising in supercomputing
and how to solve them in **real-time**,
instead of taking a **life time**
to solve them.
I invented
the fastest massively parallel processing

supercomputer
that an oil company can use
to reduce its time-to-market,
such as the time between the discovery
of crude oil and natural gas
in the Niger Delta Region
of southeastern Nigeria
and the recovery of that crude oil
and natural gas.

10.4.4 I Was Dismissed From Research Teams

For the sixteen years,
onward of age 19 and of June 20, 1974,
I conducted my supercomputer research
alone.
I did so alone
because I was ridiculed, mocked,
and rejected

by all-white research teams
that were exclusively programming
only sequential and vector processing
supercomputers.
That rejection
forced me to forge a different path
to the modern supercomputer
that solves many problems **at once**.
That rejection
forced me to think individually
on how to harness the power of
the massively parallel processing
supercomputer
and how to invent
the technology
and know it, for the first time,
as the engine that drives
the modern supercomputer.

10.5 At First, My Invention Was Rejected

10.5.1 The Grand Challenge Question

In the 1980s and earlier,
the big question
in the world of the supercomputer
was:

"Can an ensemble
of the slowest processors
outperform the fastest supercomputer
and change the way
we look at the modern computer?"

In 1989,
there were 25,000 users

of vector processing supercomputers.
I was the only full-time programmer
of the handful of
massively parallel processing
supercomputers
of the 1980s.
Gene Amdahl and **Seymour Cray**,
the two leading opponents
of the parallel processing
supercomputer,
argued that it will forever
remain impossible
to parallel process through as many as
eight processors or computer cores.
The reason my invention
of the massively parallel processing
supercomputer
made the news headlines
and was highlighted
in the June 20, 1990 issue

of *The Wall Street Journal*
was that the parallel processing
supercomputer technology of today
was then dismissed and abandoned
by the leaders of thought
in supercomputing—namely,
Gene Amdahl and **Seymour Cray**—
and was then rejected
by their 25,000 followers,
each a vector processing
supercomputer scientist.
Those 25,000 supercomputer scientists
scorned, ridiculed, and dismissed
the massively parallel processing
supercomputer
as a huge waste of everybody's time.
In the nineteen-eighties [1980s],
I was dismissed
from my research teams
and dismissed

for advocating
the massively parallel processing
supercomputer.

10.5.2 A New Way of Looking at the Computer

I experimentally discovered
that the conventional wisdom
described in supercomputer textbooks
as Amdahl's Law was wrong.
I invented
a new way of looking at the computer
and solving the toughest problems
arising in physics.
In the old way of solving
the most computation-intensive problems
in extreme-scale computational physics
and before my invention
that occurred
on the Fourth of July 1989,

the most extreme-scaled
algebraic computations
arising in physics
were solved **across**
a singular, customized,
and ultra-expensive vector processor
that processed
only one thing, or a string of numbers
called vectors, at a time.
That vector processing supercomputer
was the fastest supercomputer
during the decades of the 1970s and ‘80s.

But in my new way,
that is, the new
massively parallel processing
supercomputer,
that I mathematically and experimentally
invented
on the Fourth of July 1989
in Los Alamos, New Mexico, United States,

I figured out
how to solve, in parallel,
the most extreme-scale problems
that has algebra, calculus, and physics
at their foundations
and as their common denominators.
And I invented that technology
by parallel processing
those grand challenge problems **across**
my ensemble of 65,536 tightly-coupled,
commodity-off-the-shelf processors
that shared nothing between each other
that I visualized
as a new internet
that is a new global network of
two-raised-to-power sixteen
commodity processors.

10.5.3 The Impossible is Possible, Sometimes

In high-performance supercomputing,
wizardry
is making the impossible-to-compute
possible-to-compute.
The June 14, 1976 issue
of the *Computer World*
carried an article that was titled:

[quote]
"Research in Parallel Processing Questioned as 'Waste of Time'."
[unquote]

On the Fourth of July 1989,
the day I **invented**
the massively parallel processing
supercomputer,
the 25,000 vector processing
supercomputer scientists in the world

that were led by **Seymour Cray**
believed that
parallel processing will forever remain
a huge waste of everybody's time.

10.5.4 Chickens Versus Oxen Debate

Perhaps, it is only at a very **visceral** level
that you will recognize the **father**
of the modern supercomputer
that computes in parallel **across**
sixty-five thousand processors
or **across** sixty-five million processors.
Back in 1989,
25,000 supercomputer programmers
abandoned the pre-cursors
of the modern
massively parallel processing supercomputer
that computes **across** processors,
or **across** tiny computers.

The leader in the world of
the vector processing supercomputer,
Seymour Cray,
was the strongest opponent
of the modern, massively parallel processing supercomputer.
To date, the brainiest quote of Seymour Cray
is this:

"If you were plowing a field,
which would you rather use?
Two strong oxen
or 1,024 chickens?"

Seymour Cray would rather compute
with two strong oxen
for the two fastest, most expensive,
and customized processors
in the world.
I—**Philip Emeagwali**—would rather compute
with 1,024 chickens

for the 1,024 slowest, least expensive,
and commodity-off-the-shelf processors
in the world.
As was widely reported
—including in the June 20, 1990 issue
of the *Wall Street Journal*,
I—**Philip Emeagwali**—
experimentally discovered
that 65,536 chickens
are more powerful than two strong oxen.

10.5.5 I Was Devoured Like a Lamb

My scientific truth was **controversial**
in the 1970s and ‘80s.
In those two decades, I was banished
from the community of
25,000 vector processing
supercomputer scientists.
I was forced to parallel program

abandoned massively parallel processing supercomputers
as a lone wolf.
As the first black person
to win the top prize in supercomputing
and as the only person to win that prize alone,
I was **devoured** like a lamb
and my garments
were **soiled** in **mockery**.

10.5.6 Steve Jobs Scorned Parallel Processing

Steve Jobs
mocked parallel processing
as a huge waste of everybody's time.
In the June 10, 2008 issue
of the *New York Times*,
Steve Jobs

was quoted as telling
Apple's Worldwide Developers
that [And I quote, **Steve Jobs**]:

"The way the processor industry
is going
is to add more and more cores,
but nobody knows
how to program
those things,"

Steve Jobs continued:

"**I mean, two, yeah;**
four, not really;
eight, forget it."
[End of quote]

10.5.7 Changing the Way We Look at the Computer

Philip Emeagwali
is the subject of school reports because
my contributions
changed the way we look at
the supercomputer.
In the old way
and before my invention,
we thought of the supercomputer
as doing only one thing
at a time,
and doing that thing
with only one vector processor.
In my new way
and after my invention,
we think of the supercomputer
as doing many things
at once,

and doing those things
with millions upon millions
of processors.
That is, I experimentally discovered
how and why
the modern supercomputer
must compute in parallel
in order to simultaneously solve
millions upon millions
of the most grand challenging problems
arising in physics and mathematics,
instead of solving
only one grand challenge problem
at a time.
After my invention,
the number of parallel processing
supercomputers exploded.
Before my invention,
parallel processing was scorned,
ridiculed, and rejected

as a beautiful theory
that lacked an
experimental confirmation.
To discover or invent
the massively parallel processing
supercomputer
is to make the **impossible-to-compute**
possible-to-compute.

10.5.8 The Fastest Supercomputer

I was the first
massively parallel processing
supercomputer scientist
to record the fastest speed.
To record the fastest recorded
supercomputer speeds
and to record them **across**
a new internet

demanded that
I visualized my emails
as exploding **across** my new internet.
I visualized emails
as exploding
like bullets out of my eyes.

10.6 How I Invented a New Supercomputer

At its granite core,
the fastest supercomputer
is only fastest and super
if and only if
it computes in parallel
and did so to solve the previously
unsolveable.

10.6.1 Father of the Internet

A 12-year-old wrote to me
and asked:
"I'm doing a school report
on the internet.
Why are you called
the **father of the Internet?**"
I answered:
"The internet
has many fathers and mothers,
uncles and aunts.
But I am the only father
of the Internet
that invented a new internet.
I am the only father
of the modern supercomputer
who was in major U.S. newspapers
and who was profiled

for the invention
of the massively parallel processing
supercomputer.”

10.6.2 The First Eyewitness in Modern Supercomputing

The toughest problems
arising in extreme-scale
computational physics
are linked by a common thread, namely,
the modern supercomputer
that parallel processes
their extremely computation-intensive
floating-point arithmetical computations
and executes them **across**
an ensemble of up to ten million
commodity-off-the-shelf processors.
I, **Philip Emeagwali**,

was the first eyewitness
to discovery how and why
a new ensemble of the slowest processors
that computes together
as one seamless, cohesive
massively parallel processing supercomputer
is a new internet, *de facto*.
My invention
was how to make a new internet
that is a new global network of

65,536 tightly-coupled processors
and how to make
those processors **invisible** individually
but yet **visible**
as one seamless, cohesive supercomputer
that solves the toughest problems
arising in mathematics or physics.
Before my **invention,**
the toughest problems
arising in computational physics

were inaccurately solved
on only one processor
that was not a member
of an ensemble of processors.
After my **invention**,
the toughest problems
arising in computational physics
are more accurately solved
across
an ensemble of up to ten million
six hundred and forty-nine thousand
six hundred [10,649,600]
tightly-coupled and commonly available
processors
that shared nothing with each other.

10.6.3 My Paradigm Shift in Computing

My invention
of the massively parallel processing

supercomputer
changed the way
the petroleum industry **discovered**
and **recovered**
otherwise undiscoverable
and unrecoverable crude oil and natural gas.
My experimental discovery
of how and why parallel processing
makes
the modern supercomputer **fastest**
changed the way
we think about how to build
the **fastest** computer.
That **invention**
changed the way we solve
the toughest problems
arising in algebra, calculus, and physics.
The now ubiquitous technology
of the massively parallel processing
supercomputer
that was scorned and rejected

in the 1940s through ‘80s
is used by practicing engineers
and used to increase their productivity
and used to reduce their **time-to-market**.

10.6.4 A World Without the Modern Computer

“What will the world be like
without the parallel processing
computer technology?”

A world without the
parallel processing computer
is a world
in which ninety-nine
of the one hundred processors
inside your computer
is turned off and you’re computing at
only one percent of your computer capacity
and perhaps, achieving only one percent

productivity level.
A world without the massively
parallel processing supercomputer
is a world
in which fewer discoveries are made,
is a world
in which innovation is slowed down,
is a world
in which human progress is slowed down,
and is a world
in which the computer of tomorrow
cannot be invented today
thus making it impossible
for us to create the future.
Faster supercomputers
are where science fiction will become
non-fiction.
The fastest supercomputer
is where humanity's future takes shape.

10.6.5 Benefits of Philip Emeagwali Invention

To invent a new supercomputer
is to create new wealth.
The potential benefits to mankind
of the fastest supercomputer
were highlighted in numerous articles,
such as that in the May 8, 1987 issue
of *The Chronicle of Higher Education*
that was titled:

[quote]
"Some Hail 'Computational Science'
as Biggest Advance Since Newton, Galileo."
[unquote]

Fast forward three years,
the June 27, 1990 issue
of *The Chronicle of Higher Education*
published a follow-up article that proclaimed

that I—**Philip Emeagwali—**
had made one of the **biggest advances**
in computational science.
That **biggest advancement**
was to invent a new internet
that is a new supercomputer
and a new computer
and to invent them
by making the impossible-to-compute
possible-to-compute.
Theorized parallel processing
was in the air for the 43 years
prior to my invention.
The January 11, 1946 issue
of the *New York Times*
mentioned parallel processing
as science fiction
and as 100 computers
that could forecast the weather
all over the world

and that

[quote]

“the United States
would be divided into ‘blocks’
penetrating into the stratosphere.”
[unquote]

I—**Philip Emeagwali**—
read that *New York Times* article
and made the leap of imagination
from the 100 computers
that were theorized in 1946
to the 64 binary thousand
processors
that I theorized 28 years later
and that I experimentally programmed
43 years later
and that I used to invent
the massively parallel processing
supercomputer.

For 43 years after that
New York Times article,
parallel processing
was scorned, ridiculed, and rejected
as a beautiful theory
that lacked experimental confirmation.

10.6.6 My Eureka Moment of Discovery

Parallel processing
was experimentally confirmed
by I—**Philip Emeagwali**—and confirmed
at 8:15 in the morning
of the Fourth of July 1989
in Los Alamos, New Mexico,
United States.
On that date, parallel processing
was verified by the experiment
that I executed **across**
a new internet
that was outlined by sixteen times

two-raised-to-power-sixteen,
or 1,048,576 bi-directional email wires
that married
two-raised-to-power-sixteen processors
together
as one seamless, cohesive supercomputer
that was the precursor
to the modern supercomputer
as well as the modern computer.
That was the day
parallel processing passed
the merciless test
that I conducted **across**
my new internet.
I was in major U.S. newspapers
because I provided
the lockdown evidence
that the massively parallel processing
supercomputer
can be used to solve
the toughest problems

arising in extreme-scale
computational physics.
I attracted media attention
because my invention
of the massively parallel processing
supercomputer
yielded a measurable
and a quantum increase
in the speed of computation
that became my quantifiable contribution
to the development of the
modern supercomputer.

10.6.7 The Necessary Condition for Inventing a Supercomputer

Making a technological invention
demands an intercourse
between the sciences, and, demands
the exchange of fluids,

or rather the exchange of knowledge.
That exchange is a necessary condition
to making a scientific discovery.
Scientific babies, or new discoveries,
come from a respectful
and joyous exchange of fluids.
For me, **Philip Emeagwali**,
that exchange of new knowledge,
occurred at the crossroad
where physics, mathematics,
and computer science met
and occurred
at 8:15 in the morning
of the Fourth of July 1989.
That crossroad
was where I made the invention
that opened
new possibilities in supercomputing.

10.7 Please Don't Call Me a Genius

It's a myth that only **brilliance**
is required
to become a supercomputer genius
that invented a never-before-seen
supercomputer.
Talent is a necessary condition
but it is not a sufficient condition
for solving the toughest problems
arising in modern calculus
and in extreme-scale computational physics.
I was asked:

"Are you a black genius?"

I answered:

"The genius
is the ordinary person

that found the extraordinary
in the ordinary."

The mathematical genius
is just an ordinary mathematician
who discovered an extraordinary equation
on an ordinary blackboard.

10.7.1 The Philip Emeagwali Experiment

I used my new internet
to **experimentally confirm** that
65,536 days, or 180 years,
of **time-to-solution**
can be compressed to only one day
of **time-to-solution**
and compressed **across** a new internet
that is a new global network of
65,536 tightly-coupled processors
that shared nothing between each other.

I wrote **65,536** supercomputer codes
that each solved
an initial-boundary value problem
that arose in extreme-scale
petroleum reservoir simulation.
I message-passed
those supercomputer codes
to my two-raised-to-power-sixteen,
or **65,536,**
commonly available processors
that shared nothing between each other.
And I had as many sixteen-bit
addressed emails
that must traverse **across**
my sixteen times
two-raised-to-power-sixteen,
or **1,048,576,** bi-directional email wires
that I visualized
as tightly encircling
the fifteen-dimensional **hypersurface**

of a **hypersphere**
in a sixteen-dimensional **hyperspace**.

I visualized my new massively
parallel processing supercomputer
differently from others.
I visualized my new massively
parallel processing supercomputer
as a new internet.
I invented the technology
as the starting point
of the mass production
for the commercialization
of parallel processing computers
and massively parallel processing
supercomputers.

10.7.2 Philip Emeagwali Invention

I invented
the massively parallel processing
supercomputer.
I invented the technology
at the frontiers of knowledge
in physics, mathematics,
and supercomputing.
I invented
that never-before-understood
supercomputer
as a never-before-seen
internet.
I invented the technology
by looking beyond my blackboard,
looking towards my motherboard,
and looking **across**
my new internet
that I visualized as my new
global network of

10.7.3 Solving the Toughest Problem

Unlike the research mathematician
who only looks at his blackboard,
I looked **across**
my new internet
and I did so to both **theoretically**
and experimentally discover
that my system of diagonal equations
of algebra
that arose from solving
my specific grand challenge problem
arising in extreme-scale
computational physics
need not be equivalent
to the system of **tri-diagonal** equations
of algebra

that also arose
from solving the same
specific grand challenge problem
arising in extreme-scale
computational physics.
However, they both must solve
equivalent problems
in extreme-scale computational physics,
and solve those problems correctly.
They both must be equivalent
in the governing set of laws
of physics
from which each system of equations
of extreme-scale algebra
arose.
It was across my ensemble of
64 binary thousand processors
that I connected
with the power of algebra.
I was in the news because

I invented
how to solve
the toughest problems
arising in algebra, calculus, and physics.
At its algebra core,
that toughest problem
is a world record system of
partial **difference** equations.
I invented
how to solve those algebraic problems
and how to solve them
across a world record
number of processors.
My invention
of the massively parallel processing
supercomputer
opened the door
to extreme-scale algebra
that arises in extreme-scale
computational physics.

The system of equations
that I invented
were both **differential** and **algebraic**.
My **algebraic** equations
arose from my **differential** equations
that, in turn, arose from
the laws of physics.
Both systems of mathematical equations
could be used to **discover** and **recover**
otherwise **elusive**
crude oil and natural gas.
To push the frontier
of the fastest supercomputer
and thus to invent
a never-before-seen computer
was to harness
the massively parallel processing
supercomputer
and to use that technology
to show that the impossible-to-compute

is, in fact, possible-to-compute
and to do the impossible
at a time when
every vector processing
supercomputer scientist warned that
parallel processing will forever remain
a huge waste of everybody's time.
Throughout history, every inventor
entered the
unknown world, or the *terra incognita*
of technology,

before the invention
became the news headlines.
Their biographers,
or authorized story tellers,
came on the scene,
often decades after the inventor
is no longer with us.

10.8 Gazing Across the Millennia

In the 1970s and ‘80s,
I—**Philip Emeagwali**—
was the new and the first
massively parallel processing
supercomputer scientist
that was the lone voice
in the wilderness
of the then unknown world
of parallel processing supercomputing.
In my vision
and as the primal programmer
of a primordial internet,
I saw those processors
as 65,536
equidistant search lights
around a global sky.
I saw those search lights
as three thousand square miles
apart from each other.
I saw those search lights

pointing towards
the darkest corners
of human understanding
of global issues,
such as global warming.

The massively parallel processing
supercomputer
was not invented
by the team of 25,000
vector processing supercomputer scientists
of the 1980s.
Those conventional supercomputer scientists
scorned, ridiculed, and dismissed
the massively parallel processing
supercomputer
as a huge waste of everybody's time.
I conducted
the parallel processing experiment
that led to the invention
on the Fourth of July 1989
of the massively parallel processing

supercomputer.
I—**Philip Emeagwali**—was the only person
who discovered
how to harness
the total supercomputer power
of 65,536 separate processors.
I was the first to understand
how and why
a new ensemble of the slowest processors
that computes together
as one seamless, cohesive
massively parallel processing supercomputer
is a new internet, *de facto*.
I had the **visceral** understanding

that the massively parallel processing
supercomputer
is not a computer, *per se*.
I experimentally discovered
that my massively parallel processing
supercomputer
that I visualized
as a small global network of

65,536 commodity processors
that were identical
and that were equal distances
apart
is a small internet, *de facto*.
I experimentally discovered
a **new supercomputer**
that encircled a globe
in the way the internet does.
I was in the news for theoretically
and experimentally discovering
that parallel processing
is an entirely new way of supercomputing
across thousands or millions or billions
of tightly-coupled
commodity-off-the-shelf processors
that were identical
and that were equal distances **apart**
and that encircled
a globe in sixteen-dimensional hyperspace
and encircled it
the way the internet

encircled a globe
in three-dimensional space.

A discovery is like a stone
thrown into the pool of knowledge.
The discovery
generates wider ripples
each time we throw it
into the pool of knowledge,
or apply it.
The discovery in science
open up doors in technology
and makes the world a better place
and humanity more knowledgeable.