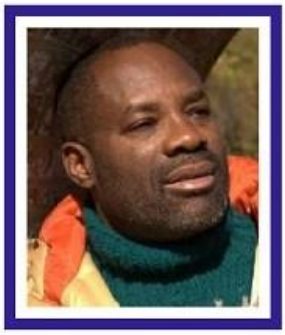
32 Biggest Advance Since Newton, Galileo—Part 1



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The computer
is the greatest invention
of the 20th century.
Parallel processing
is the biggest advance
in the history of the computer.

32.1.1 Inventing a New Supercomputer

The history of civilization
is the history of technology.
Fire is man's first invention,
or rather man's first discovery.
Who domesticated the first chicken?
Who domesticated the first goat?
Who rode the first horse?
The names of ancient scientific pioneers
are lost in the mist of time.
Who solved the first
quadratic equation?
Who programmed
the first ensemble of processors
that led to the discovery
of the modern supercomputer
that computes in parallel?
Parallel processing—the technology
that makes the new computer **faster**
and makes the new supercomputer **fastest**—

is the most important invention
in the history of the computer.
The experimental invention
of the massively parallel processing
supercomputer
—that solves many problems **at once**,
instead of solving only one problem
at a time—
and its absorption into new computers
and into new supercomputers
is one of computing industry's
most hopeful narrative.
For two hundred millennia,
we discovered
to make our world
a more knowledgeable place.
We discovered
to discover new fields of study.
The new field of study
that I discovered,
in the 1970s and '80s,
is called massively parallel processing
supercomputing.

I discovered that new field of study
by conducting my sixteen-year-long quest
between fields,
between classical physics
and modern mathematics,
between abstract calculus
and extreme-scale algebra,
and between
the most computation-intensive
floating-point arithmetical operations
and the largest ensemble of processors.
The supercomputer
is a witness to humanity's
most computation-intensive problems.
The supercomputer
doesn't just solve the toughest problems
in extreme-scale computational physics.
The supercomputer
is the modern **diving rod**
for discovering more crude oil
and natural gas.
The supercomputer
is the **crystal ball**

for foreseeing otherwise unforeseeable
global warming.
The supercomputer
is an instrument for telling the future.
I discovered that
the global circulation model
that is executed **across** a new internet
that's a new global network of
commodity processors,
or a new global network
of as many computers,
and that emulates a new supercomputer
can be used to gaze **across** the centuries.
The invention of how to compute
in parallel
was a revelation
that changed our knowledge
of how to compute things
that were previously impossible
to compute.
In the 1980s and earlier,
the big overarching question in
supercomputing was:

“Can an ensemble
of all the slowest processors
in the world
outperform the fastest supercomputer
and change the way
we look at the modern computer?”
For the fifteen years
onward of June 20, 1974,
that parallel processing
grand challenge question
kept me up at night.
In the final days
leading to my experimental discovery
of massively parallel processing
supercomputer,
a discovery that occurred
on the Fourth of July 1989,
I had my heart in my throat.
I had the visceral feeling
that my massively parallel processing
supercomputer results
will be historic.
That invention

of the massively parallel processing
supercomputer
is the reason 12-year-olds
are writing school reports titled:

"The Contributions
of **Philip Emeagwali**
to the Development of the Computer."

On that Fourth of July 1989,
the first direct measurement
of the fastest computation ever recorded
across
an ensemble of processors
was recorded.
On that Fourth of July 1989,
I experimentally discovered
that massively parallel processing
supercomputers
can be used to solve
computation-intensive problems
that neither sequential processing
supercomputers

nor vector processing supercomputers
can solve.
My invention
was about making grand challenge
initial-boundary value problems
of extreme-scale computational physics
that are impossible-to-solve
possible-to-solve.
I figured out
how to massively parallel process
the most computation-intensive problems
arising in physics
and how to massively parallel process them
so that a **time-to-solution**
of thirty thousand years
can be reduced
to a **time-to-solution**
of just one day.
My contribution to physics
is this:
Before I figured out
how to harness the power
of the massively parallel processing

supercomputer
that occurred on the Fourth of July 1989,
the most extreme-scale
computational physics codes
were only executed on only one
supercomputer.
After my invention
the most extreme-scaled
computational physics codes
were only executed **across**
millions upon millions
of commodity-off-the-shelf processors.

32.1.2 The Land Before Parallel Processing

In summary, **we knew**
the land before parallel processing
and we named that land
sequential processing,
or the land where we computed
only one thing **at a time**.
We knew the most important laws in physics

and we knew them
three centuries and three decades ago.
We knew how to encode
those laws of physics
as the most advanced expressions
in calculus
called partial differential equations
and we knew them
nearly a century and a half ago.
We knew how to discretize
those partial differential equations
to their algebraic approximations
and we knew them
almost a century ago.
We knew how to further reduce
the systems of equations of algebra
and how to reduce them
to an equivalent set of
floating-point arithmetical operations
and we knew them
over half a century ago.
We had been executing
those floating-point arithmetical operations

since 1946,
the year the first digital, programmable
supercomputer
was invented.
We knew the land before
parallel processing
as the land where we computed
one thing **at a time**.

32.1.3 The Land After Sequential Processing

In the 1980s, we did not know
the land after sequential processing,
or computing many things
at once.
What made the news headlines
in 1989
was that I—**Philip Emeagwali**—
invented something
that was considered impossible
to do, namely, I crossed from
the land of sequential processing

to the land of parallel processing.
What made the news headlines
was that I figured out
how to solve
the most computation-intensive problems
arising in extreme-scale
computational physics.
Solving the grand challenge problem
of computational physics
sharpened and **deepened**
our understanding of both the computer
and the supercomputer,
and changed the way we look
at both technologies.
I arrived at that unknown world
by forging a path
never taken before.
I arrived from a narrow footpath
that was never taken before.
I arrived at the *terra incognita*
of supercomputer knowledge
and arrived

holding a small lantern
that was dimly lit.

32.1.4 Thirty Thousand Years in One Day

The modern supercomputer
that computes **faster**
by massively parallel processing **across**
millions upon millions of processors
is the **fastest** computer in the world.
The massively parallel processing
supercomputer
became the world's **fastest** computer
by computing many things
at once,
instead of computing only one thing
at a time.
The modern supercomputer
that solves millions upon millions
of problems **at once**,

instead of solving only one problem
at a time
helps make the world
a more knowledgeable place.
The modern supercomputer
that reduced **time-to-solution**
from thirty thousand [30,000] years
to just one day
increased our understanding
of our universe.
My discovery
of how to reduce **time-to-solution**
and how to reduce it
from 180 years to just one day
opened the door
to the modern supercomputer
that inspired the reduction
of **time-to-solution**
from thirty thousand [30,000] years
to just one day.

32.1.5 Please Allow Me to Introduce Myself

Please allow me to introduce myself.

I'm **Philip Emeagwali**.

The inventor is a prisoner
of his invention
and somewhat need an outsider
to fully explain his invention
to him.

Yet, allow me to introduce myself.
I'm a supercomputer scientist
that is best known for inventing
a new internet
that is a new supercomputer
and a new computer
that opened our eyes
to a new computer science
and allowed us to see the modern computer

in a different way.

32.1.6 My Origin Story

A story in the June 14, 1976 issue
of the **Computer World** magazine
was titled:

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

Two years earlier,
I began programming supercomputers
and began on Thursday June 20, 1974
at age 19.
I began supercomputing
with one of the world's **fastest**
supercomputers
that was in Corvallis, Oregon, United States.
That supercomputer
was the first to be rated

at one million instructions per second.
As a 19-year-old supercomputer
programmer,
I felt like a small boy
that was in charge of a big ocean liner
that turns slowly.
Three weeks after I began programming
supercomputers,
I was on the cover of a newspaper
that circulated in the cities of
Monmouth and Independence, Oregon,
United States.
I became a local celebrity.

32.1.7 My Growth as a Supercomputer Scientist

Over the years, I realized that
in Africa, a breakthrough technology
is a sacred object.
The African that invents
a groundbreaking technology
can occupy the position

between **Albert Einstein**
and **Nelson Mandela**
and occupy that position
in the minds of Africans
at home and in the diaspora.
That African inventor
is invited to seat
on the African high table.
The invention of the fastest supercomputer
is a concrete and visible achievement
that everybody understands
as pushing the frontier of technology
as well as the boundary
of human knowledge.
None of the 25,000
vector processing supercomputer
programmers
of the 1980s
showed the massively parallel processing
supercomputer some love.
In the 1970s and '80s,
the *terra incognita*
that was the emerging field of

massively parallel processing
supercomputing
was as empty as a ghost town
that had only one permanent resident.
I—**Philip Emeagwali**—
was that permanent resident
of the farthest frontier of supercomputing
called massively parallel processing.
In the 1980s, I discovered
the massively parallel processing
supercomputer
to be like a book
that sat on the library shelf
for 180 years
and sat
without once being checked out.
I was the only fulltime programmer
of the most massively parallel processing
supercomputer
of the 1980s.
I visualized that massively
parallel processing supercomputer
as a small copy of the Internet.

32.1.8 My Struggles as a Supercomputer Scientist

The reason my experimental discovery
made the news headlines
was that for the four decades
onward of 1946
the parallel processing machine
was a supercomputer-hopeful
that no supercomputer scientist
understood
what made it super.
The new supercomputer
that I invented
on the Fourth of July 1989, in turn,
gave birth to a new field computer science.

A new supercomputer
gives birth to
a new computer science.

32.1.9 Biggest Advance Since Newton, Galileo

The May 8, 1987 issue
of *The Chronicle of Higher Education,*
carried an article 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
carried an article that proclaimed
that I—**Philip Emeagwali**—
had made the biggest advance
in computational science.
Back in 1989,
one of the science news headlines
was that an **African Supercomputer Wizard**
in the United States
had experimentally discovered

how and why parallel processing
makes modern computers **faster**
and makes the new supercomputer
the **fastest**
and invented
how and why to use
that **new supercomputer knowledge**
to build a **new supercomputer**
that encircled the globe
in the way the internet does.
I am that African supercomputer scientist
that was in the news
back in 1989.
I was in the news
for inventing
the massively parallel processing
supercomputer.
I was in the news
for inventing that new supercomputer
across
a new internet
that was a new global network of

65,536 tightly-coupled processors.
I was in the news
for experimentally discovering
that new supercomputer
in Los Alamos, New Mexico, United States
and for experimentally discovering
that new supercomputer
at 8:15 in the morning of Tuesday
the Fourth of July 1989,
the US Independence Day.
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 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
in the manner the internet encircled
the Earth in three-dimensional space.
At first, my experimental discovery
of the massively parallel processing
supercomputer
was ridiculed, mocked, and rejected.
Everybody in the supercomputer community
said I had made an embarrassing mistake
but every supercomputer scientist
was embarrassingly mistaken.
I was in the news
because I invented
how to synchronously communicate
and how to simultaneously compute
and how to communicate
and compute **together**
and how to do both
as one seamless, cohesive unit.
That cohesive unit

was my new supercomputer *de facto*.
That cohesive unit
was defined around
a sixteen-dimensional hyperball
that is a new internet, by definition.
That cohesive unit
was a supercomputing machinery
that I used to **send** and **receive** emails
to and from
65,536, or two-to-power sixteen
sixteen-bit long
email addresses.
It was not enough that I knew the
Philip Emeagwali internet
and knew that internet
back in 1974
and knew that new internet
as a new supercomputer.
That new internet
that was a never-before-seen computer

must know **Philip Emeagwali**
as its sole programmer
and inventor.

32.1.10 Visualizing a Small Copy of the Internet

I invented
a new internet
that is a new global network of
64 binary thousand
commodity-off-the-shelf processors
and I **invented**
how to program that new internet
to solve the toughest problems
arising in extreme-scale
computational physics,
such as the excruciatingly-detailed
general circulation modeling
to foresee otherwise unforeseeable
global warming.
That new internet
was a small copy
of a never-before-understood Internet,

that had only 65,536 processors
tightly encircling a globe
instead of billions of computers
loosely encircling the globe
that is planet Earth.
I visualized each of my
two-to-power sixteen
commodity processors
as identical
and as equal distances apart
and as encircling a globe
in a sixteen-dimensional hyperspace.
And I visualized my ensemble
of processors
as evenly distributed **across**
the hypersurface of a hypersphere
in a sixteen-dimensional universe.
I visualized my ensemble
of processors
as outlining a new internet
that I visualized
in my sixteen-dimensional universe.

My new internet married
my 64 binary thousand processors
and married them **together**
and married them
as one seamless, cohesive supercomputer
that had one processor
at the **crossroad**
of my sixteen email pathways.
Those sixteen pathways
were mutually orthogonal
in the sixteenth-dimensional hyperspace.
That is, they were perpendicular
in the sixteen directions
of an imaginary
sixteen dimensional universe.

32.1.11 Philip Emeagwali Supercomputer

I invented
how to speed up computations **across**

that new internet
and how to speed it up from
one hundred and eighty [180] years,
or sixty-five thousand
five hundred and thirty-six [65,536] days,
within only one processor
to just one day
across that new internet
that's a new global network of
sixty-five thousand
five hundred and thirty-six [65,536]
processors.
I invented
my new massively parallel processing
supercomputer
and I invented it
by visualizing my email messages
as firing like bullets **out of my eyes**
and as emails coming from computers
within a new internet
in a sixteen dimensional hyperspace.

32.1.12 How I Invented a New Internet

I'm **Philip Emeagwali**.

I'm the subject of school reports
because I invented
a new supercomputer
that was the precursor
to the modern supercomputer.
I invented a new supercomputer
that is a small copy
of a new internet.
The new internet that I invented
is defined and outlined by an ensemble
of 65,536
commodity-off-the-shelf processors
that are identical
and that are equal distances
apart.
That new internet

is complex, abstract, and a mystery.
The **65,536** processors of my new internet
were married together
by **1,048,576** bi-directional email wires
and married together
as a new supercomputer
that computed cohesively
and did so as one new integrated
supercomputer
and communicated seamlessly
as one new internet.
I began supercomputing at age 19
on June 20, 1974
in Corvallis, Oregon, United States.
I was the lone wolf
and the only full time programmer
of the fastest supercomputer
of the 1980s.

32.1.13 The Holy Grail of Supercomputing

Today, the fastest supercomputer
costs the budget of a small nation.
The fastest supercomputer
is programmed by thousands
of supercomputer scientists.
The fastest supercomputer
occupies the space of a soccer field.
The **Holy Grail** of the fastest possible
supercomputer
is to marry together
all the processors in the world
and marry them
to all the computers in the world
and marry them
to all the supercomputers
in the world
and marry processors and computers
and supercomputers together
and as a never-before-seen internet

that will become a never-before-seen
planetary-sized supercomputer
that will turn our science fiction
to our descendant's non-fiction.

32.1.14 Changing the Way We Look at Computers

I'm **Philip Emeagwali**.

I discovered the supercomputer paradigm
in which the boundary
between the computer and the internet
is blurred.
That invention
of the parallel processing supercomputer
made the news headlines because
it had a richness of consequences **across**
science and society.
When I began supercomputing
—on June 20, 1974—I envisioned

a planet-sized global
network of computers
that was the precursor
to the Internet of today.
In subsequent years, I invented
a new internet
that I called a HyperBall
that was described in the book titled:

"History of the Internet."

I, Philip Emeagwali,
experimentally discovered
that my ensemble of processors
defined and **outlined**
a new internet
that I visualized
as my small copy
or **blueprint** or **prototype**

of the Internet.
Prior to my invention
of the massively parallel processing
supercomputer
that I invented
on the Fourth of July 1989,
each processor within my ensemble
of 64 binary thousand processors
was like a dim light
in a sea of darkness.

On the Fourth of July 1989,
I experimentally discovered
that when 64 binary thousand processors
are communicating together
and are computing together
as one seamless, cohesive
supercomputer,
then my sixty-five thousand

five hundred and thirty-six [65,536]
processors
became as bright as the sun.

I was in the news headlines
because I brought a new face,
a new voice, and a new vision
to the story of the development
of the modern supercomputer
that is not a computer *per se*
but that is a new internet *de facto*.
The lone wolf inventor
of a new internet
must invent every node
of his new internet.
A new internet
could only be invented
by a cross-disciplinary inventor
that commanded a broad overview
of the frontiers of mathematics,

of the frontiers of physics,
and of the frontiers of computer science.
That inventor of a new internet
must have the intellectual maturity
needed to bring together
discoveries and inventions
from disparate fields,
such as modern calculus,
extreme-scale algebra,
and massively parallel processing.
That inventor of a new internet
must bring together
highly specialized knowledge
that were previously siloed.

32.1.15 Philip Emeagwali's Second Internet

I invented a second new internet
that I called a Cosmic Ball.

In the mid-1970s, my new internets
remained science fiction.
But on the Fourth of July 1989,
I constructively reduced
that HyperBall science fiction
to **nonfiction**
and I did so
when I became the first person
to experimentally discover that
an ensemble of the slowest
65,536 processors
in the world
can be harnessed to compute faster than
the fastest supercomputer
in the world
and compute fastest while solving
the toughest problems
arising in extreme-scale
computational physics.

32.1.16 Contributions of Philip Emeagwali to Physics

I was in the news
onward of the Fourth of July 1989
because I experimentally discovered
how to reduce the performance abyss
between the sequential
or the vector processing supercomputer
and the massively parallel processing
supercomputer.
I did not experimentally discover
the technology
of the massively parallel processing
supercomputer
and invented that technology
by inventing how to **tweak**
the sequential processing codes
that arose in extreme-scale
computational mathematics.
Nor did I constructively reduce to practice,
or experimentally invent,

the new supercomputer
and did so by inventing how to **vectorize**
the vector processing codes
that arose in extreme-scale
computational physics.
I invented
the parallel processing supercomputer
from first principles,
and invented that supercomputer
from the laws of classical physics,
and invented that supercomputer
from the partial **differential** equations
of modern calculus
that encoded those laws,
and invented that supercomputer
from the partial **difference** equations
of extreme-scale algebra
that approximated those
partial **differential** equations.
In the early 1980s, I invented
nine partial differential equations
of modern calculus
that fit the second law of motion

of physics,
rather than invent
a law of motion of physics
that fit the partial differential equations
on the mathematician's blackboard
and in the calculus textbook.
Mathematics is not a science
in its own right.
The new calculus that I invented—namely,
the nine system of
partial differential equations
called Philip Emeagwali's Equations—
is the **middle science** that mediates
between the mind of man
and the motion of objects.
It is that **intermediary position**
of my new calculus
that prompted the debate
on whether my new mathematics
is discovered or invented and patentable.
I see the nine Philip Emeagwali's Equations
as inventions
that were abstracted from

the discovery
of the Second Law of Motion of physics
that occurred 330 years ago.
The physical law
that I encoded
into Philip Emeagwali's Equations
existed 13.82 billion years ago
—when the universe was born
from the Big Bang explosion—
but the mathematical terms
that codified those laws
could have been known 13.82 billion years
ago but were not known then.

32.1.17 Contributions of Philip Emeagwali to Computational Physics

The nine new partial differential equations
that I invented
were beings of reason
but what they simulated were real beings.

The reason I make this distinction
between beings of reason
and real beings
is because I am often asked:
“Did you discover or invent
the Philip Emeagwali’s Equations?”
My answer is that I discovered
the Philip **Emeagwali’s Equations**
if my partial differential equations existed
in textbooks on modern calculus
and that I invented
the Philip **Emeagwali’s Equations**
if my partial differential equations
did not previously exist
in calculus textbooks.
In computational physics,
extreme-scale algebra
is the recurring decimal
and the elephant in the room.
Algebra
that arose from the
partial differential equation

is the way the supercomputer
experience calculus.

32.1.18 Contributions of Philip Emeagwali to the Modern Supercomputer

Those experimental discoveries
of how to massively parallel process
across a new internet
that is a new global network of processors
enabled me to forge my path
to the farthest frontier of supercomputing
that is the modern supercomputer.
What made the news headlines
in 1989
was that I invented
the technology of the massively
parallel processing supercomputer
and that I constructively reduced
that technology to practice

and I did so on the Fourth of July 1989
and I did so when supercomputer textbooks
considered parallel computing many things
at once
to be **impossible**
and I did so in 1989
when all the 25,000
vector processing supercomputer scientists
in the world
considered it to be impossible
to parallel process
the most extreme-scale problems
arising in computational physics—such as
general circulation modeling
to foresee otherwise unforeseeable
climate changes.

32.1.19 Making the Impossible Possible

The June 14, 1976 issue
of the *Computer World* magazine

reported on a special session
on parallel processing
that was held at the
National Computer Conference
in New York City.
The *Computer World* magazine reported that
a panelist of supercomputer experts
at the 1976 National Computer Conference
were of the opinion that

[I quote]:
"Those machines
often turn out to be large and clumsy,
and several of the large
parallel processor designs
since then **have failed**.
Now we are moving into the modern era."
[End of quote]

Back in 1974,
massively parallel processing
supercomputer coding
was like rubbing rocks

until they caught fire.
Sometimes, it is difficult
to translate thoughts
from one medium to another.
The article is written to be read
on a page
but the algorithm is invented to be coded
on a processor.
And trying to explain
my abstract supercomputer algorithms
to the layperson
is like trying to rub rocks
until they catch fire.
I began supercomputing
eighteen months after the last man
walked on the moon.
On June 20, 1974,
the day I began sequential processing
supercomputing,
it was easier to travel to the moon
than to travel to the frontier

of the massively parallel processing
supercomputer
that is the precursor
to the modern supercomputer.
In the 1970s and ‘80s,
to parallel process **across** a new internet
that was a global network of
64 binary thousand
commodity-off-the-shelf processors
was like walking alone
through a dark rain forest
and doing so alone
with only a dim lamp.
My quest for the massively
parallel processing supercomputer
was my attempt to discover
that the impossible-to-compute is, in fact,
possible-to-compute.

32.1.20 Solving the Toughest Problem in Physics

Parallel processing
is the technique of fastest supercomputing
that is fastest
by computing many things
at once, or in parallel,
instead of computing only one thing
at a time, or in sequence.
To the supercomputer scientist
of 1989 and earlier,
to invent the parallel processing
supercomputer
was to experimentally discover that
massively parallel processing
the toughest problems
arising in extreme-scale
computational physics
is not a waste of time.
I was in the news in 1989
because I invented

how to save time
and how to do so by reducing
65,536 days, or 180 years,
of time-to-solution on one processor
that is not a member
of an ensemble of processors
and reducing that **time-to-solution**
to only one day of **time-to-solution**
across
an ensemble of 65,536
tightly-coupled processors
that were the building blocks
of a new internet
that was a new supercomputer
and a new computer.
My experimental discovery
was recognized in the June 20, 1990 issue
of *The Wall Street Journal*.

32.1.21 Changing the Way We Look at the Computer

The *Wall Street Journal*
reported that my experimental discovery
of the massively parallel processing
supercomputer
will change the way
we look at the supercomputer.
In the old way, we thought about
a conventional supercomputer
as powered by one strong ox.
That strong ox
was my metaphor for one **powerful**
processor.
In the new way, we think about
a modern supercomputer
as powered by sixty-five thousand
five hundred and thirty-six [65,536]
chickens.
Those chickens were my metaphors
for my sixty-five thousand

five hundred and thirty-six [65,536]
weak processors.
I theorized that
the Grand Challenge Problems
of our children's children
will be solved by one billion grasshoppers.
Each grasshopper was a metaphor
for a computer on the Internet of the future.

32.1.22 Recognition From President Bill Clinton

Eleven years after my
experimental discovery
of how to solve a Grand Challenge Problem
and how to solve it **across**
a new internet
that is also a new supercomputer
and a new computer,
that invention of parallel processing
was reconfirmed
by then President Bill Clinton
who acknowledged my invention

in his speech of August 26, 2000.
That speech of President Bill Clinton
was delivered
to the **Nigerian parliament**
in Abuja, Nigeria.
My contribution
to the development of the computer
is the subject of school reports because
I discovered that
the impossible-to-compute is, in fact,
possible-to-compute.
My technological quest
was for a new supercomputer
that is a new internet
that is defined and outlined
by a new global network of
65,536 commodity processors
that were identical
and that were equal distances
apart.
My technological quest
was for the fastest supercomputer

and for how to reduce
65,536 days, or 180 years,
of **time-to-solution**
on only one processor
that is not a member
of an ensemble of processors
and how to reduce
that **time-to-solution**
to just one day of **time-to-solution**
across a new supercomputer
that is a new internet
and that is defined
as a new global network of
65,536 processors.

32.1.23 Bullets Out of My Eyes

I visualized my sixteen times
two-to-power-sixteen email wires
as pieces of fire woods

that connected
my two-to-power sixteen processors
that each contained **kerosene**.
My scientific quest
was to experimentally discover
the new knowledge,
or the intellectual spark,
that will set my new internet
on fire.
As the lone wolf
massively parallel processing
supercomputer scientist
of the 1980s,
it was imperative that I know
how my ensemble
of 64 binary thousand processors
were married together
by my ensemble
of one binary million email wires
and married together
as one seamless, cohesive supercomputer
that is not a computer *per se*
but that is a new internet *de facto*

and that I know that new
global network
both forward and backward.
That new knowledge
was not known
to any of the 25,000 vector processing
supercomputer scientists
of the 1980s.
That new knowledge
was the reason
I could set my new supercomputer
on fire.
For me, **Philip Emeagwali**, 1989
was the year of fire,
the year the massively parallel processing
supercomputer
became the fire
the supercomputer scientist
can't put out.
The 65,536 simultaneously sent
and synchronously received
email messages
were like bullets out of my eyes.

32.1.24 Searching for a Black Goat at Night

Searching for the parallel processed solution
to the toughest problem in calculus
was like searching for a black goat
at night.
My journey to the farthest frontier
of technological knowledge
and my quest for the fastest supercomputer
that is a new internet
was a mathematical journey
from fiction to fact to forecast.
A theory
is an idea that's not positively true.
Prior to my experimental discovery
of the Fourth of July 1989,
the mechanism
by which 64 binary thousand
computational physics codes
were synchronously emailed

to as many processors
remained unknown
and remained a theory
that was not positively true.
My experimental discovery
of the Fourth of July 1989
put to rest the saying that
parallel processing
is a beautiful theory
that lacked experimental confirmation.
Prior to my 1989 experimental discovery,
parallel processing was widely caricatured
and rejected
as a huge waste of everybody's time.
Back in the 1970s and '80s,
parallel processing was ridiculed
as a beautiful theory
that lacks experimental confirmation.
And my quest for the fastest
massively parallel processed computation
that could be executed **across**

two-raised-to-power sixteen processors
was like searching for a black box
in a dark sixteen-dimensional universe.

32.1.25 Searching for a New Supercomputer

Looking back from June 20, 1974,
in Corvallis, Oregon, United States,
my lone search
for how parallel processing
makes computers **faster**
and for how an ensemble of
64 binary thousand processors makes
supercomputers **fastest**
was like going into the **Sambisa** forest
of Northern Nigeria
alone
and going there to search for
the elusive **Chibok** girls
that were held hostage
by **Boko Haram** fighters.
Parallel processing was the Holy Grail

and the **Chibok** girls of supercomputing.
Searching for the fastest
parallel processing supercomputer
was like walking at night
and along an uncharted road
in the **Sambisa** forest of Northern Nigeria
and doing so armed against
Boko Haram fighters
with only a **small lantern**.
My quest was for new knowledge,
new algebra, new calculus,
and new computational physics.
My quest was also for
a new computer science
that must arise from a new computer
that is a new supercomputer
and that is a new internet *de facto*.
My contribution
to the development of the computer
is this:
I experimentally discovered
that the impossible-to-compute

is, in fact, possible-to-compute.
On June 20, 1974, and at age 19,
I was like a mouse
crawling inside the supercomputer
that was at 1800 SW Campus Way,
Corvallis, Oregon, United States.
Over the next decade and half,
I grew into the 34-year-old lion
that was protecting
the world's fastest supercomputer
that I discovered to be a new internet
that is a new global network of
65,536 tightly-coupled processors.

32.1.26 A Father of the Internet

Who is the father of the Internet?

The internet
has many fathers and mothers

as well as many uncles and aunts.

However, I—**Philip Emeagwali**—is the only father of the Internet
that invented a new internet.

I visualized my fastest calculations
across my new internet
before I **experimentally discovered**
the fastest calculations
across my new global network of
64 binary thousand
commodity processors,
or **across** as many tiny, identical
computers.
I visualized my new internet
in a fictional sixteen-dimensional
universe
but I experimentally discovered
my new supercomputer
in our factual three-dimensional
universe.

Fast computation defines
the computer.
Recording a **never-before-recorded**
speed in computation
redefines the supercomputer
and redefines the boundary
of human knowledge.
The fastest computation
is the most objective
and the most measurable contribution
to the development of the computer.
The supercomputer speedup
—of from **one day** to **180** years—
that I experimentally discovered
on the Fourth of July 1989
and in Los Alamos, New Mexico,
United States,
made the news headlines because
it was a quantum increase
in parallel processing
supercomputer speed,

instead of an incremental increase
in sequential processing
supercomputer speed.
That invention
of the parallel processing supercomputer
was also a paradigm shift in thinking,
instead of an evolutionary shift
in thinking.
That invention of the precursor
to the modern supercomputer
opened our eyes
to the richness of consequences
arising from parallel processing **across**
millions upon millions of
tightly-coupled commodity-off-the-shelf
processors
that shared nothing with each other.
That invention
allowed us to see the modern computer
in a different way, namely,
as parallel processing **across** processors.

As reported in the news media,
such as the June 20, 1990 issue
of *The Wall Street Journal*,
my invention
of the massively parallel processing
supercomputer
was not in the new fastest
supercomputer.

My **invention**
was in discovering
a new way of thinking about
the new fastest supercomputer
and thinking about the supercomputer
of tomorrow
not as a computer *per se*
but as a new global network of
tightly-coupled processors
that shared nothing with each other and
that is a new internet *de facto*.
My **experimental discovery**

of massively parallel processing
was processor-agnostic
—or independent of processor
technology—and was a blueprint
for a never-before-seen internet.
The invention
of a faster supercomputer
is a historical milestone
that measures human progress.
The reason the invention
of how to compute faster
—and how to do so
by changing the way we look at
the modern supercomputer—
is a marker of progress
is that it's an invention
that makes the **impossible-to-compute**
possible-to-compute.
The invention
of the massively
parallel processing supercomputer

proves that humanity is progressing
in the right direction.

I'm **Philip** **Emeagwali**
at emeagwali.com.
Thank you.