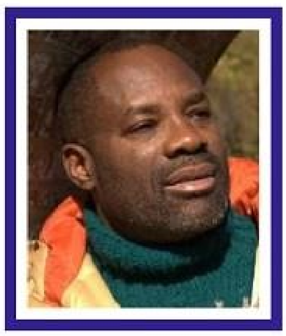
23 Philip Emeagwali Internet



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23.1 How I Discovered Parallel Processing—My Breakthrough Moment

A Child Soldier's Story?

My scientific story is more fragmented
than the story of the theoretical physicist
Albert Einstein.
It was the story of my journey
to the frontier of
extreme-scale computational physics.
That journey to discover
how to solve
the toughest problems
in mathematical physics
was interrupted
during the last thirty months
of the 1960s.
That journey was interrupted
when I fled from my all-boys
Catholic boarding school—named

Saint George's Grammar School,
Obinomba (Nigeria).
I fled from Saint George's Grammar School
in late April 1967
and I fled because the Nigerian Civil War
was in the air.
I fled to become a 12-year-old refugee
in the break-away
and short-lived nation
of Biafra.
Two months after I fled from **Obinomba**
(Nigeria) to **Agbor** (Nigeria)
to **Onitsha** (Biafra),
and on the Sixth of July of 1967
that Nigeria-Biafra War began.
On the Fourth of October
of 1967,
my ancestral hometown
of Onitsha (Biafra)
was heavily bombarded for 24 hours
and bombarded from **Asaba** (Nigeria)
and bombarded from across the River Niger.
The following day,

that artillery bombardment
of **Onitsha** (Biafra)
by the Nigerian army
was followed by the invasion
of my hometown.
That night, **Onitsha**
was invaded by a 10-boat armada
that carried five thousand [5,000]
Nigerian soldiers.
Those Nigerian soldiers
were led by Murtala Mohammed,
who would later become the president
of Nigeria.
One in fifteen Biafrans died
when that Nigerian Civil War ended.
The Nigerian Civil War
was a nightmare and a bloodbath.
The Nigerian Civil War ended
after thirty months of non-stop fighting
and on January 15, 1970.
One million soldiers
died at the war fronts
of the Nigerian Civil War.

And about half a million
women and children
died in Biafran refugee camps.
I survived two years
in Biafran refugee camps
and survived six months of bloodbath
near the Oguta War Front.
I survived a war
that was described as
Africa's bloodiest war.

23.1.1 One Day We Had to Run!

Biafra
was located in the southeastern region
of Nigeria, West Africa.
My family of seven children
lived in six refugee camps
within Biafra.
For two years and three months,
onward of April 1967,
my family lived in refugee camps
in the Biafran cities of Onitsha,

Ogidi, Oba, Awka, Awka-Etiti,
and Ndoni.
During the months of January,
February, and March of 1968,
Russian Ilyushin bombers
and Mig fighters
were bombing and strafing
our neighborhoods of around
14 Mba Road, Onitsha.
On my 14th birthdate of August 23, 1968,
my postal address was:
Chukwurah Philip **Emeagwali**
Saint Joseph's Refugee Camp,
Awka-Etiti, Biafra, West Africa.
On the cover of the TIME magazine
that was dated August 23, 1968
is an artist's portrait of "Colonel Ojukwu,"
the leader of Biafra.
The cover story of that issue
of TIME magazine
was titled "Biafra's Agony."
For us, the agony was real.
Half of the refugees

at our Saint Joseph's Refugee Camp,
Awka-Etiti, Biafra,
were living skeletons.
My father, Nnaemeka James Emeagwali,
was the live-in refugee camp nurse
at Saint Joseph's Refugee Camp.
In August 1968,
my father told me that
half of the children
in our refugee camp,
including my two-year-old brother, Peter,
had kwashiorkor,
a rare malnutrition disease
caused by lack of protein.
At Saint Joseph's Refugee Camp
of Awka-Etiti (Biafra),
children and grandparents
that did not survive kwashiorkor
were buried without funerals
and buried at our backyard.
In Biafra, meat, pepper, and even salt
were almost as scarce as gold.
Three charity organizations

—**The Red Cross**,
the Roman Catholic relief organization,
named **Caritas,**
and the **World Council of Churches**—
provided to our refugee camp
cornmeal, Norwegian dried stock fish
named "okporoko,"
and powdered milk.
The relief foods
were secretly flown into Uli airstrip
of Biafra.
That 27-month refugee experience
was the reason
the United Nations
has the portrait of **Philip Emeagwali**
—along with the portraits
of the likes of **Albert Einstein**—
in its Gallery of Refugees
Who Made a Difference.

23.1.2 A Child Soldiers' Story

In July 1969
and at the banks of the River Niger
at Ndoni, Biafra,
I was conscripted at gun point
and conscripted
as a 14-year-old soldier
into a war that was on par
with the American Civil War
or the Spanish Civil War.
Without any formal training
as a soldier,
I was marched at gun point
to the Biafran side
of the Oguta War Front.
At Oguta War Front,
Biafran soldiers were living on
less than one cigarette-sized cup
of garri a day.
Garri is pulverized, fried cassava root.
Biafran soldiers added palm kernel nuts
and water from the Oguta Lake
to their garri.
When I arrived at Oguta War Front,

some Biafran soldiers
had gone for days without food
and they were threatening
to leave their holes.
After forty-eight [48] hours without food,
I became woozy with hunger.
Because they was nothing to eat
at Oguta War Front,
I was immediately reassigned
to the Officer's Mess (or kitchen)
of the Biafran Army at Ndoni.
Two months before my arrival
at the Oguta War Front (Biafra),
and in May 1969,
Murtala Muhammad,
who would later become
the president of Nigeria,
and **Mohammed Shuwa**
were given command of the Nigerian army
at Oguta War Front.
In late May 1969,
and two months before I arrived
at Oguta War Front,

Mohammed Shuwa
had defeated the Biafran army
and captured downtown Oguta.
A few weeks later, downtown Oguta
was recaptured by the Biafran Army
but recaptured
after a loss of 500 soldiers.
I was conscripted into the Army
and conscripted at the market at Ndoni
(Biafra).
I was conscripted
to replace one of the 500 Biafran soldiers
that died in the battle
to recapture downtown Oguta (Biafra).
The battle of Oguta War Front
was personally commanded
by Odumegwu Ojukwu,
the leader of Biafran nation.
When I arrived at Oguta War Front,
Joseph "Hannibal" Achuzie,
nicknamed "air-raid"
was commanding the Biafran soldiers.
I learned that **Olusegun Obasanjo,**

who would later become
the three-time president
of Nigeria,
was commanding the opposing
Nigerian Army
at the Oguta War Front.
Olusegun Obasanjo
arrived in Oguta War Front
in July 1969
and arrived at the same time
that I arrived in Oguta War Front.
In July 1969, I arrived at Oguta War Front
and arrived as an untrained soldier
and arrived at about the time
Colonel Olusegun Obasanjo
arrived with 30 tanks
and 10,000 trained soldiers.
Those Nigerian soldiers
killed or wounded 2,200 Igbo civilians.
In July 1969, Biafran soldiers
were trained at the war front.
Biafra soldiers were only trained
to aim-and-shoot-to-kill.

Three months after I arrived
at Oguta War Front,
Colonel Olusegun Obasanjo
recaptured the city of Oguta
and did so on October 9, 1969.
I was a Biafran child soldier
that was transferred from
the Oguta War Front
to serve as a cook
in the Officer's Headquarters
at the bank of the River Niger,
at Ndoni, Biafra.
I served in the Biafran army
for the six months that preceded
the end of the Nigerian civil war
that ended
on the Fifteenth of January of 1970.

23.1.3 From War Front to Science Front

My journey
to the frontier of the supercomputer
was a journey

from the war front of Biafra
to the science front of the United States.
My technological journey
to the frontier
of the massively parallel processing
supercomputer
began on June 20, 1974
and began on a sequential processing
supercomputer
that was in Corvallis, Oregon, United States.
However, that technological journey
was bifurcated by racism.
And discordant voices
drowned the voice
of the lone wolf research
supercomputer scientist
that was alone at the frontier
of a new internet
that is a new supercomputer.
Who is **Philip Emeagwali**?
The following story
is a sixty-minute excerpt
from my sixty-year-story.

At age 34, and at 10:15 in the morning New York Time 905
Tuesday the Fourth of July 1989,
the US Independence Day,
I saw something
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.
I was witnessing
the birth of a new era
in the history of the computer.

I was witnessing
a paradigm shift
in the supercomputer world.
I was witnessing
a change of tectonic proportions
that will forever affect
the way we think about the computer.
I was witnessing
the birth of a new computer
that is powered by an ensemble
of a hundred commodity processors,
rather than computing
with only one processor.
I was witnessing
the birth of a new supercomputer
that is powered by a global network of
65,536 commodity-off-the-shelf processors,
rather than supercomputing
with only one customized vector processor.
I was witnessing
the birth of a new internet of tomorrow
that could be powered by
a global network

of one trillion processors
that **emulates**
one seamless, cohesive supercomputer.

I was gazing **across** the centuries.
For me, **Philip Emeagwali**,
the massively parallel processing
supercomputer,
was my supercomputing equivalence
of a moonshot project.
And as a matter fact,
the fastest supercomputer
costs as much as the spacecraft
that took men to the moon.
In supercomputing,
the Holy Grail was to
compute one billion times faster
and to compute
with as many commodity processors
that compute together
to solve extreme-scale problems
in computational physics.

23.1.4 Quest for Fastest Supercomputers

I began my quest
for the fastest supercomputer
on Thursday June 20, 1974
at age nineteen [19]
at 1800 SW Campus Way,
Corvallis, Oregon, United States.
Fifteen years later, I knew a thing or two
about how and why
parallel processing makes
the computer **faster**
and makes the supercomputer **fastest**.
Today, my research interest
has shifted
to passing on my massively
parallel processing supercomputer
discoveries and inventions
and to passing them on to
the next-generation
of quantum computer scientists.
Back in 1974,
no supercomputer scientist

had any sense of how
the massively parallel processing
supercomputer
could be used
to solve the toughest problems
in computational physics.
And no supercomputer scientist
understood what lies within the hood
of a theorized
massively parallel supercomputer
of 1974.
But today, the massively parallel processing
supercomputer
that was science fiction in 1974
is a reality that gave the petroleum industry
the ability to extract
more crude oil and natural gas
from the Niger-Delta oil fields
of my country of birth, Nigeria.
It should not come as a surprise
that the petroleum industry
purchases one in ten

massively parallel processing
supercomputers.

23.1.5 Please Allow Me to Introduce Myself

I invented a new internet
that is a global network of
65,536 commodity-off-the-shelf processors
that are identical
and that are equal distances
apart.
And I invented
how to use that new internet
to make modern computers **faster**
and make the new supercomputer
the **fastest**.
Please allow me to take
a retrospective look
on my early supercomputing years,
namely, the sixteen years onward of
June 20, 1974
at Corvallis, Oregon, United States.
In those sixteen years,

I conducted supercomputer research
on how to harness
the total supercomputing power
of sixteen massively parallel processing
machines,
that were each powered by
an ensemble of up to
two-to-power sixteen
commodity-off-the-shelf processors
that were **married together**
as one cohesive supercomputer-hopeful
and **married together**
by sixteen times
two-to-power sixteen
commodity email wires.
In the 1970s, I visualized each
massively parallel processing supercomputer
that I theorized
not as a new computer *per se*
but as a new internet *de facto*.
This series of lectures
is on how and why
parallel processing

is the necessary technology
for manufacturing
the fastest supercomputers.
In my lecture series,
I will explain
why my world's fastest computation
that I recorded
on the Fourth of July 1989
and that I recorded
across the slowest processors
made the news headlines in 1989
and was recorded in the June 20, 1990 issue
of *The Wall Street Journal*.
That experimental discovery
of massively parallel processing
is often remembered
as my contribution
to the development of the fastest computers
and supercomputers.
I experimentally discovered
that a parallel processing supercomputer
that is defined and outlined
by an ensemble of the slowest processors

can be harnessed
to compute faster than
the fastest sequential processing
supercomputer
and to compute faster than
the fastest vector processing
supercomputer.
That experimental discovery
is my contribution
to the deeper understanding
of the new internet
that is a global network of processors
and that is the fastest supercomputer
of today.

23.1.6 How I Discovered Parallel Processing

Ever since the supercomputer
that computed automatically
and used only one CPU
was invented in 1946,
the first real-hope
for supercomputing **across**

a billion processors
did not emerge until I—**Philip Emeagwali**—
experimentally discovered
how and why we can communicate
and compute **across** a new internet.
That new internet
is a global network of sixty-five thousand
five hundred and thirty-six [65,536]
commodity-off-the-shelf processors,
or a global network of as many
identical computers.
That supercomputer experimental discovery
that I made
on the Fourth of July 1989
made the news headlines in 1989.
To make my invention
of a new supercomputer,
I used the most complicated mathematics
from the world of physics, calculus,
and computers
and I used that abstract mathematics
to work out
how to parallel process

across a new internet
that is a global network of
65,536 commodity processors
and I used that advanced
mathematical knowledge
to work out
which data from my
extreme-scale computational physics codes
to email
and which data not to email.
The new partial differential equations
of modern mathematics
that I invented and used
was the cover story
of the June 1990 issue
of the *SIAM News*.
The *SIAM News*
is the flagship publication
of the research mathematics community.
The *SIAM News*
is published by the Society for Industrial
and Applied Mathematics.
The new mathematical knowledge

in the *SIAM News*
is written by research mathematicians
and written only for
research mathematicians.
On the Fourth of July 1989,
I experimentally confirmed
that I could use a new internet
that's outlined by 64
binary thousand processors
and use that new internet
to solve the toughest problems
in extreme-scale computational physics
and solve those problems
by dividing each into
64 binary thousand problems
and solve them
64 binary thousand times faster
than one processor
solving those sets of
64 binary thousand problems alone.
Since the first supercomputer of 1946,
the technological need
to solve the toughest problems

in extreme-scale computational physics
is the primary source of inspiration
for inventing
the fastest supercomputers.
In 1989,
nine in ten supercomputer cycles
were consumed by
extreme-scale computational physicists
who constructed
computation-intensive
global circulation models
or constructed highest-resolution
petroleum reservoir simulators
or coded
the toughest problems
in computational fluid dynamics.
My **experimental discovery,**
of the massively parallel processing
supercomputer
that occurred on the Fourth of July 1989,
that occurred
across a new internet
that is a global network of

64 binary thousand processors
opened the door
to the state-of-the-art new supercomputers
that now computes
10 binary million times faster.
That new supercomputer, in turn, creates
a new computer science.
Before my discovery,
or in the 1980s or earlier,
the one thousand fastest supercomputers
in the world
used only one processor.
After my discovery,
or after the Fourth of July 1989,
the one thousand fastest supercomputers
in the world
parallel processed and computed
with thousands or millions
of commodity-off-the-shelf processors.
The economic importance
of my experimental discovery
of the modern supercomputer
can be concluded from the fact that

the fastest supercomputer
costs the budget of a small nation.
The story of how I got to do
such an expensive supercomputer
experiment
and do it alone
is the subject of another lecture.

23.1.7 The Answer is Blowing in the Wind

The massively parallel processing
supercomputer
is the most important tool
at the frontiers of knowledge
of computational mathematics,
computational physics,
and computational medicine.
The sequential processing supercomputer
and the vector processing supercomputer
opened the fields
of computational mathematics,
computational physics,
and computational medicine.

And the massively parallel processing
supercomputer
continues to push the boundaries
of human knowledge
and push it **across**
extreme-scale science,
technology, engineering, and mathematics.
Parallel processing
is at the root of the modern computer.
Parallel processing
changed and redefined the supercomputer
from being powered by
only one isolated processor
to being powered by
an ensemble of millions of processors.
Within the massively parallel processing
supercomputer
is a world of magic
in which we can foresee
previously **unforeseeable**
natural events.
And explain phenomena
that our recent ancestors

could not explain.
In John 3:8,
our biblical ancestors stated:
[And I Quote]
“The wind blows as it wills,
and you hear the sound of its passage,
but you cannot say where it comes from
or where it goes.
This is how it is
for the children of the wind.”
[End of Quote]
Due to the discovery
of some laws of physics,
and the invention
of the most abstract
partial differential equations
of modern calculus,
and the discovery
of how to solve the most large-scale
system of equations
of modern algebra,
and the invention
of a new internet

that's a massively
parallel processing machine
that's faster than
the fastest sequential processing
supercomputer
or faster than
the fastest vector processing supercomputer,
and due to that invention
of parallel processing
that enables us
to do many things **at once**
or in parallel
the 21st century
children of the wind
can say where the wind comes from.
The modern supercomputer scientist
and the meteorologist
are the new children of the wind
that were described in the Bible.
But in the **early** 20th century,
the meteorologist didn't have
a supercomputer
and, therefore, cannot say

where the wind comes from.
By the **late** 20th century,
the meteorologist did have
a massively parallel processing
supercomputer
and used it to say
where the wind comes from.
Your television meteorologist
told you where the wind comes from
because her team
of extreme-scale computational physicists
computed at the fastest speeds
and computed
using a massively parallel processing
supercomputer
and using it as the driving force
behind the forecast of the meteorologist.
It takes three decades
to understand, discover, and invent
the **new** physics, the **new** calculus,
the **new** algebra, the **new** computation,
and the new communication
that makes it possible

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to say where the wind comes from.
It took me 30 years
to understand where the wind comes from.
It will also take you 30 years
to understand the answer
that's blowing in the wind.
I was once asked
to give a 30-second answer
to the question:
"How do we compute
where the wind comes from?"
I answered:
We compute the speed and the direction
of the wind
and we compute them
by employing the laws of physics
to formulate
an initial-boundary value problem
of modern calculus;
and solving that
initial-boundary value problem
that, in turn, is defined
by a system of

coupled, non-linear, time-dependent, and
state-of-the-art
partial differential equations
of modern calculus
that encoded those laws of physics;
and by employing a system of
linear equations of algebra
that approximated those
system of
partial differential equations;
and, and more recently,
by employing
10 binary million commodity-off-the-shelf
processors
and using those commodity processors
to solve those algebraic equations,
and solve them
at the world's fastest speeds
of computation.
The massively parallel processing
supercomputer
is the essential tool
that is used to know which way

the wind blows
and know the way
before the wind blows.
I experimentally discovered
how to know
which way the wind blows
and do so **across** a new internet
that's *de facto* a new supercomputer.
That new supercomputer wind forecast
is called the evening's weather forecast.

23.2 Fourth of July 1989

23.2.1 My Breakthrough Moment

It was my fluid dynamical calculations
of the Fourth of July 1989
that I executed **across** a new internet
that's a global network of
65,536 commodity processors
that were identical
and that were equal distances

apart
that brought me
my first public recognition
as a supercomputer scientist.
I was asked to explain
how I realized that
on the Fourth of July 1989
that I had a breakthrough
in massively parallel supercomputing
and to explain
how my invention
pertained to computational fluid dynamics.
Back in the 1980s,
25,000 vector processing
supercomputer scientists
ridiculed, mocked, and rejected
the massively parallel processing
supercomputer.
The June 14, 1976 issue
of the *Computer World* magazine
that was the flagship publication
of the computer industry
mocked the untried

and the unproven
parallel processing supercomputer
technology.
That June 14, 1976 article
was titled:
“Research in Parallel Processing
Questioned as Waste of Time???”
According to the guiding lights
in the world of the computer
—namely, **Gene Amdahl**
in the world of the sequential processing
supercomputer,
Seymour Cray
in the world of the vector processing
supercomputer,
and **Steve Jobs**
in the world of the computer—
and according to these three digital giants
it would forever be physically impossible
to achieve a computer speed increase
of a factor of eight
and do so in the world of
the parallel processing computer.

At 10:15 in the morning New York Time
Tuesday the Fourth of July 1989,
I realized that
I have massively parallel processed
and that I did so
when I experimentally discovered
that I have solved
65,536 initial-boundary value problems
of modern mathematics
and computational physics.
I realized that
I have solved
those initial-boundary value problems
and that I have solved them simultaneously
or at once or in parallel,
instead of solving them
one by one or in sequence.
My sixteen-year-long scientific quest
for the experimental discovery
of parallel processing
was punctuated
by several Eureka! Moments.
My greatest Eureka! Moment

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was when I experimentally discovered
that instantaneous
supercomputer speed increase
of a factor of 65,536
in the speed of my
computational physics codes.

23.2.2 Lone Wolf at the Farthest Frontier

I worked **alone**
and I experienced those Eureka! Moments
alone.
I was the lone programmer
of the **first and the only**
massively parallel processing machine
in the world
powered by sixty-five thousand
five hundred and thirty-six [65,536]
processors.
I was the lone wolf programmer
at the farthest frontier of supercomputing.
Because I **worked alone**,
nobody else witnessed my moment

of experimental discovery
of the massively parallel processing
supercomputer
that I hoped will be the precursor
to the modern supercomputer
of today
and, hopefully, the modern computer
of tomorrow.
Fast forward three decades,
my moment of discovery
is reproduced in every modern computer
and in the fastest supercomputer
and was what prompted.
That experimental discovery
of the massively parallel processing
supercomputer
prompted Steve Jobs
to leave a telephone message for me
back in June 1990.
Not witnessing the first Eureka moment
of the modern supercomputer
that occurred at 10 a.m.
the Fourth of July 1989

was like not witnessing
the first human flight
that occurred
at the turn of the twentieth century.
Yet, we accept it as an act of faith
that the first human flight occurred.
And we must accept it
as an act of faith
that the first modern supercomputer
was discovered.

23.2.3 Knowing I Made a Breakthrough

I recognized that
I had a breakthrough supercomputer
discovery
because the speed of my floating-point
arithmetical operations
instantaneously increased
and did so by a factor of
64 binary thousand,
or sixty-five thousand

five hundred and thirty-six [65,536].
The reason my speedup of
65,536 days to one day
made the news headlines
was that it was a milestone
in the history of computing.
My proof
that it was a breakthrough supercomputer
discovery
was that soon after it was clarified
as a historic speedup
it became practical and cost-effective
to manufacture supercomputers
that computed in parallel.
The first commercially available
massively parallel processing
supercomputers
used 65,536, or more,
commodity-off-the-shelf processors.
Each processor was akin
to a tiny computer.
The modern supercomputer
uses millions upon millions

of commodity processors
and uses them to compute in parallel
and to reduce the **time-to-solution**
of extreme-scale problems
in computational physics
and computational mathematics.
After my discovery,
extreme-scale computations
that formerly took 180 years, or 65,536 days,
of **time-to-solution**
now takes just one day of **time-to-solution**.
That extraordinary speedup was achieved
when programmers
massively parallel comput**ed**
and did so **across**
64 binary thousand
commodity processors.

23.2.4 How I Recorded the Fastest Computation

Back in 1974,
supercomputer coding
was like rubbing rocks

until they caught fire.
But after fifteen years
of daily supercomputer coding,
the process of coding
an ensemble of processors
became easier.
As a research computational mathematician,
I translated my new calculus
into my new algebra.
And I translated my new algorithms
for solving my new algebra
into my new codes.
And I translated my new codes
from the blackboard
to the motherboard.
And I emailed my new codes **across**
a global network of
64 binary thousand motherboards
that, in turn, defined my new internet.
Supercomputing **across** my new internet
was like translating the Bible
that was written only in the Latin language
and translating that Bible

into my ancestral Igbo language
and then
mailing 65,536 copies
of that Igbo version of the Bible
to as many Igbo-speaking persons
in my ancestral hometown
of Onitsha (Nigeria).
Just as I had to have a command knowledge
of the Latin and the Igbo languages
in order to translate that Bible,
I had to similarly
have a command knowledge
of physics and mathematics and computers
in order to translate **across** those fields.
My computational speed increased
by a factor of
two-raised-to-power sixteen
because I used emails
that I sent to and received from
sixteen-bit long addresses.
A perennial problem in parallel processing
was to experimentally discover
how to, for instance,

map 64 binary thousand computer codes
and map them
to as many processors.
Each computer code represents
what computational mathematicians call
an algebraic representation
of an initial-boundary value problem
of modern calculus.
For me, each computer code
was akin to a general circulation model
that I had to map
to 64 binary thousand processors.
I had to map those computer codes
while maintaining
nearest-neighbor connectivity
and maintaining
a one-to-one correspondence
between the codes and the processors.
I was in the news in 1989
and in the June 20, 1990 issue
of *The Wall Street Journal* because
I solved that perennial problem
of massively parallel processing

across a new internet
that I visualized
as my global network of
64 binary thousand processors.
I had assigned
sixty-five thousand
five hundred and thirty-six [65,536]
initial-boundary value problems
to sixty-five thousand
five hundred and thirty-six [65,536]
processors.
I assigned
my computational physics problems
to processors
and I assigned them
with a one-to-one correspondence
that maintained the much desired
nearest-neighbor connectivity
that will be a **precondition**
to my experimentally discovering
the world's fastest speed
in computation.
I experimentally discovered

how to assign initial-boundary value problems
to processors
that each had its own operating system
and memory,
and I did so
by using the **binary reflected naming code**
that can be used
in the x- and/or y- and/or z-directions.

23.2.5 The Birth Cry of a New Internet

My experimental discovery
that occurred at 10:15 in the morning New York Time
the Fourth of July 1989
was an emotional experience
that words alone cannot describe.
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 940
on a processor.
And trying to explain
my abstract supercomputer algorithms
is like trying to rub rocks
until they catch fire.
On the Fourth of July 1989,
I sat in front of my keyboard
and computer monitor.
I was shaking
from my experimental observation.
My jaws dropped
because I was seeing supercomputer speeds
and speedups
that were previously unseen.
I was speechless because
I was staring at a new supercomputer.
That first experience
of massively parallel supercomputing
was an out-of-the-body, spiritual experience,
and an epiphany.
Supercomputing 65,536 times faster
and supercomputing **across**

a new internet
that was a global network of
65,536 processors
was an experimental discovery
that hit me like a thunderbolt.
That discovery
was the most cathartic moment in my life.
That discovery
was a visceral experience.
That discovery
was the birth cry
of a new computer
that is also a new internet.
That discovery
made me cry in my ancestral Igbo language.
I cried:
Eiwoooooooooooooooooooo
Eiwoooooooooooooooooooo
Eiwoooooooooooooooooooo.
That discovery
was cathartic because I realized that
I possessed new and important knowledge
that should move humanity forward.

I discovered
how to build a new supercomputer
that is also a new internet.

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