THE NETWORKING AND INFORMATION TECHNOLOGY RESEARCH AND DEVELOPMENT (NITRD) PROGRAM

NITRD

What Supercomputers Can Do for Us!
Newsletter December 2020

DISCOVER NITRD INNOVATIONS FOR YOU!

The Director's Corner - Kamie Roberts

I am pleased to present NITRD's December's newsletter that offers insight into the Nation's priorities and what activities NITRD's member agencies conduct to achieve the President's priorities.

- ***Snippets***: Well, they are exactly that, snippets (with links) to fascinating agency projects in networking and information technology.
- ***Topic of the Day***: We have not run out of problems to solve! This month we are examining supercomputers and how they are tackling unique problems. For example, supercomputers are a powerful new weapon against the SARS-CoV-2 virus and the disease COVID-19 causing the global pandemic.
- ***Agency Corner***: The Department of Energy is often associated with supercomputers, so we highlight DOE in our Agency Corner.
- ***Innovation through NITRD***: We introduce our readers to NITRD's High End Computing Interagency Working Group, which coordinates Federal agency activities on computing technologies.
- ***Event Highlights***: We highlight here a workshop NITRD held on strategic computing.
- ***NITRD Staff & Etc.***: In this section, we acquaint our readers with NITRD's IT team. They have gone above and beyond in their work to create new IT platforms and ensure NITRD's virtual work is smooth sailing during these unpredictable and often challenging times of COVID-19. Also, we present here the Administration's efforts to build a quantum workforce and support ***STEM education*** to achieve this goal. At the end of the newsletter, you will find the names for the ***abbreviations*** and a list of ***informative sources*** on the topics presented here.

We invite you to take a look at the transformative IT innovations that have found an important place in American life. As the Director of NITRD, I challenge you to ***Discover NITRD Innovations for You!***

Snippets . . . Discover NITRD Innovations for You!

What NITRD's Federal agency members are doing in scientific computing technologies!

Findings at **NIST** indicate **quantum computers may have higher 'speed limits'** and the computational speed limits could originate from more than just energy availability, but also other facets of physics.

NIST researchers are working on a puzzle. **'Coupled' quantum dots** share an electron, which makes a quantum bit (i.e., qubit), but quantum physics cannot describe how electrons do this. Why is this important? The pair of quantum dots act as interacting islands of electric charges and this may provide quantum computers the ability to store information as qubits. Pretty cool!

COVID-19 High Performance Computing Consortium is a public-private partnership between **NSF**, **NASA**, and **DOE** and its **National Laboratories**, together with members of industry and academia, to combat COVID-19. Eight weeks after the President announced the launch of the program, 60 active projects were utilizing the available supercomputers. At the end of June, Michael Kratsios, the Chief Technology Officer of the United States, announced that the world's fastest computer (at that time!), Japan's Fugaku, had joined this White House OSTP-led effort. Participation has continued to rise, such that by November 2020, the consortium had 92 active projects and over 40 consortium members. This included seven national labs, 11 universities, eight affiliates, and international members from the United Kingdom, Switzerland, South Korea, and Japan.

NSF funded the **Extreme Science and Engineering Discovery Environment (XSEDE)**, which coordinates the sharing of supercomputers, high-end visualization, and other data analysis **resources**. XSEDE provides a portal and serves as a hub for the COVID-19 HPC Consortium, matching researchers with computing resources.

NIST developed **four new tools** to give researchers the ability to effectively search the **COVID-19 Open Research Dataset (CORD-19)**. NIST developed these search tools in response to the **White House's** lead to establish a free scientific coronavirus literature resource of over 280,000 articles (and growing).

Federal agencies have provided open-access to data and computational resources related to COVID-19 that are available to researchers on **the NIH Office of Data Science Strategy webpage**.

Take a look at the **scope of projects** running on the supercomputer Summit at DOE's **ORNL** to improve our understanding of COVID-19 in our pursuit of vaccines and targeted therapies to combat the virus. Researchers have had success – out of 8000 compounds, the **supercomputer Summit identified 77** that warranted further investigation in the lab for potential treatments and vaccines that could target COVID-19.

Using ML on a supercomputer platform, **researchers at DOE'S LLNL designed antibody sequences** that could bind and neutralize SARS-CoV-2, the virus that causes the disease commonly known as COVID-19. The resulting 20 antibody sequences will be improved through computational iterations to improve machine learning designs of antibodies.

A public-private partnership between **DOE's ANL and Cerebras Systems** leverages AI and one of the world's fastest supercomputers to advance COVID-19 research. ANL used AI and ML on its supercomputer to process massive datasets that ultimately will predict drug candidates for testing.

Topic of The Day – What Supercomputers Can Do for Us!

As we live through the COVID-19 pandemic, we focus our attention on vaccines, therapeutics, and other options to control the outbreak. But there is a *new* weapon in our arsenal against the virus …

supercomputers. The U.S. has some of the most powerful supercomputers on Earth that will provide researchers the opportunity to tackle this problem in unique ways. What is it that makes supercomputers so different from the computers you and I use?

Supercomputing Related Terminology

Flops *– An acronym for "**FL**oating-point **O**perations **P**er **S**econd" and is a measure of a computer's performance, i.e., calculations performed per second. A **petaflop** is the computing speed of one quadrillion (10^{15}) calculations per second.*

Exaflop *– One billion billion calculations per second (10^{18}).*

Parallel computing *– Multiple processors work together concurrently on a problem. Supercomputers use parallel computing. In contrast, sequential computing has one processor working on a problem.*

Petascale *– Supercomputers solve problems at the petascale level, which is 1 quadrillion (10^{15}) operations each second.*

Exascale *– Computing systems that can calculate at least 1 exaflop calculations per second.*

Deep Learning *– A subfield of ML that uses artificial neural networks inspired by the brain structure and teaches computers to learn, supervised or not, by example. "Deep" indicates the number of layers in the neural network.*

Top 30 Supercomputers today

Red indicates a U.S. facility

**** indicates a facility at a DOE National Laboratory***

1. **Fugaku, Japan**
2. **Summit, ORNL U.S.***
3. **Sierra, LLNL U.S.***
4. **Sunway TaihuLight, China**
5. **Selene, NVIDIA Corporation U.S.**
6. **Tianhe-2A, China**
7. **JUWELS Booster Module, Germany**
8. **HPC5, Italy**
9. **Frontera, UTexas U.S.**
10. **Dammam-7, Saudi Arabia**
11. **Marconi-100, Italy**
12. **Piz Daint, Swiss National Supercomputing Centre**
13. **Trinity, LANL U.S.***
14. **AI Bridging Cloud Infrastructure (ABCI), Japan**
15. **SuperMUC-NG, Germany**
16. **Hawk, Germany**
17. **Lassen, LLNL U.S.***
18. **Pangea III, France**
19. **TOKI-SORA, Japan**
20. **Cori, LBNL U.S.***
21. **Nurion, South Korea**
22. **Oakforest-PACS, Japan**
23. **HPC4, Italy**
24. **Tera-100-2, France**
25. **Stampede2, UTexas U.S.**
26. **DGX-SuperPOD, NVIDIA Corporation U.S.**
27. **Gadi, Australia**
28. **Taiwania 2, Taiwan**
29. **AiMOS, Rensselaer Polytechnic Institute, U.S.**
30. **Taranis, France**

Coming online:

Frontier, ORNL U.S.*

Aurora, ANL U.S.*

El Capital, LLNL U.S.*

A 'standard' computer, such as a laptop, is a machine that stores and processes information and then generates an output. In comparison, supercomputers do this also but much faster, with more data, in a different manner, and in less time than it would take a modern personal computer (PC). Supercomputers have many processors working concurrently and in parallel by splitting the computational problem into blocks where each processor works on a different piece. Think of it this way: You are part of a team working in a lab on a complex problem. The lab manager divides up the projects among lab members and each person works on their part of the project at the same time as other members – all part of a team effort to solve the complex problem. That is what a supercomputer does. To give you an idea of how amazing this is, one supercomputer working on a problem is comparable to 100 million PCs working on the problem!

Supercomputers today handle a petascale (10^{15}) of operations each second and though this seems fast, the next step – exascale computing – will be transformative because it is 1000 times faster than petascale. This means exascale computing will execute a quintillion (10^{18}) calculations per second or a "billion billion operations" – in other words, calculations that are 50 times faster than today's supercomputers are able to process. This computing speed is five times faster than Summit – the fastest supercomputer in the U.S – that has a speed of 200 petaflops.

The human brain has 86 billion neurons on average – round that up to 100 billion and multiply by 15 million to get the problem-solving ability of exascale. The computing achievement of exascale will bring us increased scientific discovery and provide enhanced national security in the not-too-distant future. To do this, the Exascale Computing Project (ECP), a collaboration between DOE Office of Science and NNSA, seeks to accelerate exascale computing ecosystems. Many, but not all, of the U.S.-funded supercomputers are at DOE's National Laboratories. ORNL's **Frontier** and ANL's **Aurora** supercomputers will each be an exascale system providing 1.5 exaflops (see upper box) when they come online in 2021. And they keep getting faster… In June 2020, **LLNL broke ground** on an exascale computing facility that will house the supercomputer El Capitan, which is expected to be deployed in 2023. El Capitan will be able to do 2 exaflops (that is a million-trillion) calculations per second. Exascale computing is so important because it will bring together and process immense quantities of data and provide boundless possibilities for the future.

Simulations are run on the planet's most powerful supercomputers – **Frontera**, **Longhorn**, **Summit**, **Theta**, and **Comet.** Frontera, the 9th fastest, is a NSF-funded supercomputer where 80% of available processing time is through the NSF Petascale Computing Resource Allocations program. Many researchers are using the NSF-funded Frontera supercomputer in the fight against the pandemic. For example, a researcher is using Frontera to determine how to reduce the **risk of the virus spreading in contained environments**, such as inside an airplane.

The White House OSTP-led **COVID-19 High Performance Computing Consortium** is facilitating the world's most powerful high-performance computing resources for those working in research against the threat of COVID-19. Let's look at some examples of the work advanced by the COVID-19 HPC Consortium. The world's 2nd fastest supercomputer, Summit, has groundbreaking architecture designed to integrate AI techniques, which allows researchers to investigate what known drugs could attach at the junction where the spikes on the SARS-CoV-2 virus affix to enter the human host cell. One promising compound found in the Summit analysis is a plant chemical found in many fruits and vegetables. This chemical, quercetin, did block SARS-Cov-1's entry into a host cell. Summit identified another candidate, hypericin (from the plant St. John's Wort) that could interfere with the virus affixing to the human cell. In 2021 Summit will have additional assistance when its ten times more powerful sister supercomputer, Frontier, comes online!

COVID-19 HPC Consortium projects are envisioned to provide benefits in the near-term. But the magnitude can seem daunting. There are more than a billion molecules that need to be screened (*e.g., virtually putting a molecule next to a protein to see if it binds)* to find ones that can interact and disrupt the SARS-CoV-2 virus that causes COVID-19. The problem? If we used every supercomputer on Earth, we could not screen that many molecules in a reasonable amount of time! **The solution** … ANL is leading a large collaboration that uses AI-driven molecular dynamics simulations. They are integrating AI and ML with physics-based tools to train the ML system to identify factors that would make a molecule a promising candidate.

In another Consortium project, one **team** looked at how genes involved in the COVID-19 disease inflammation responses may affect African Americans compared to European Americans. They used supercomputer time to examine massive data sets and found that ten genes important to infection, inflammation, and immunity responded differently in these two groups, which may reflect selection pressure from historical regional pathogens. These differences could have implications for COVID-19 treatments. With the goal of developing a preventive treatment against the virus, **another study team** examined active plant-based biological compounds (i.e., phytochemicals) from Indian medicinal plants that have been suggested to have anti-viral properties. Check out some of these **really amazing projects** that are using supercomputers to help solve the global pandemic and stay tuned for their important results!

Agency Corner: Department of Energy (DOE)

DOE is involved with many aspects of the sciences, for example: advanced manufacturing, artificial intelligence, clean energy, climate change, cybersecurity, energy efficiency, energy sources, environmental clean-up, nuclear security, vehicles of the future, and future computing. DOE is at the forefront in high-performance computing as many of the Nation's top supercomputers are located at the **DOE National Laboratories**. Supercomputing or HPC is moving to the next step that will combine new advances in AI, ML, data analytics, and modeling and simulation to engineer new designs that will increase memory, storage, and compute power. This is how the U.S. will achieve exascale computing, which in turn will bring breakthroughs in many diverse fields. Two organizations within DOE (the Office of Science and NNSA) established the Exascale Computing Initiative (ECI) in 2016 to achieve exascale computing by the mid-2020's. One of the major parts of ECI is **ECP** – a project supported by ASCR, DOE Office of Science, and NNSA – that is focused on bringing the **hardware**, **software**, and **integrated application** required for an exascale system. Exascale will not just make computing systems faster and more powerful, but also will expedite advances in scientific discovery, energy innovations, national security breakthroughs, and economic transformations.

DOE's National Laboratories (NL)

Office of Science

- **Ames Laboratory (Ames)**
- **Argonne National Laboratory (ANL)**
- **Brookhaven National Laboratory (BNL)**
- **Fermi National Accelerator Laboratory (FNAL)**
- **Lawrence Berkeley National Laboratory (LBNL)**
- **Oak Ridge National Laboratory (ORNL)**
- **Pacific Northwest National Laboratory (PNNL)**
- **Princeton Plasma Physics Laboratory (PPPL)**
- **SLAC National Accelerator Laboratory (SLAC)**
- **Thomas Jefferson National Accelerator Facility (JLab)**

National Nuclear Security Administration

- **Lawrence Livermore National Laboratory (LLNL)**
- **Los Alamos National Laboratory (LANL)**
- **Nevada National Security Site (NNSS)**
- **Sandia National Laboratories (Sandia)**

Office of Nuclear Energy

- **Idaho National Laboratory (INL)**

Office of Fossil Energy

- **National Energy Technology Laboratory (NETL)**

Energy Efficiency & Renewable Energy

- **National Renewable Energy Laboratory (NREL)**

Office of Environmental Management

- **Savannah River National Laboratory (SRNL)**

Exascale is not the only cutting-edge technology DOE is preparing to launch, another is quantum-related technologies.

Questions? Need More Information…

· **Quantum physics** (or quantum mechanics) describes matter and energy at the atomic level, in which both particles and waves act as the other. It is quantum physics that governs how quantum computers will store information ("qubits"), in that each qubit (*see quantum computing below*) can be any fundamental particle displaying quantum behavior.

To generate a qubit, a particle must be put into a state called superposition, where the particle is in multiple states at the same time. This means it is a challenge to keep qubits stable. Also, measuring qubits immediately changes the superposition state – qubits are very sensitive! To contrast classical computers with quantum computers, think of each playing a game of chess. The classical computer would only examine one move at a time, where a quantum computer would play the game by scrutinizing all possible moves at the same time and then picking the best … you would not want to play chess with a quantum computer!

· **Entanglement** is where qubits connected share a similar state (0 or 1) and additional qubits increases processing power – the key that separates quantum computing from classical computing.

· **Testbed** is a platform for testing new technologies, scientific theories, and novel cutting-edge products.

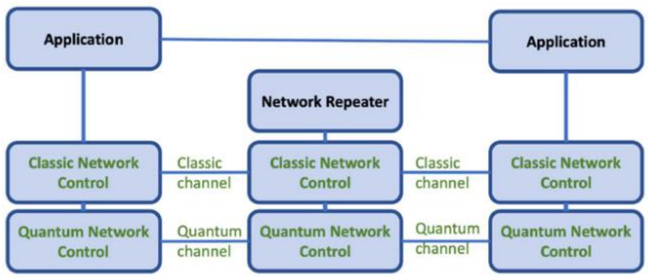
· To understand NQI, check out **The U.S. National Quantum Initiative: From Act to action**

· Quantum information brings together quantum physics and computing theory. To gain more insight into this, check out **NIST's History & Future of Quantum Information**

· For an in-depth review of quantum Internet, check out **Quantum internet: A vision for the road ahead**

· **Report of the DOE Quantum Internet Blueprint Workshop**

QIST seeks to bring new types of information processing, sensing, computing, and networking (communications), all of which will lead to cutting-edge insights and opportunities for solving science's intractable problems. The **U.S. National Quantum Initiative** (NQI), signed into law in 2018, established a collaboration between NIST, NSF, and DOE, together with academic institutions and the industry sector, to prompt new development and the use of QIST advances. As part of this initiative, DOE is ushering in a communication system based on quantum mechanics – the quantum Internet – with the 17 national labs as the backbone for this endeavor. Efforts have begun with ANL and the University of Chicago forming a public-private partnership to create a "quantum loop" extending 52 miles. The next step in developing this quantum network will be for scientists to devise a three-node testbed extending 80 miles. So what is so special about a quantum Internet?



A quantum network with both quantum and classic (as used today) components.
From: Report of the DOE Quantum Internet Blueprint Workshop

A quantum Internet wouldn't function separately or necessarily replace today's Internet; rather, the quantum properties add to its communications abilities (*see diagram above*), potentially accelerating data transmission. And importantly, it will be more secure because qubits cannot be copied or amplified. It has been suggested that quantum transmissions are almost impenetrable to being monitored, thus making the networks unhackable. There are three hardware parts to a quantum Internet: (1) the ***quantum channel***, which provides a physical connection for qubit transmission, in other words, communication lines similar to telecom fibers used today; (2) ***quantum repeaters***, the intermediate nodes that are located at points on the optical fibers to allow the qubits to travel long distances; and (3) the ***end nodes*** (*see diagram below*) where applications run and serve as the quantum processors linked to the quantum Internet.

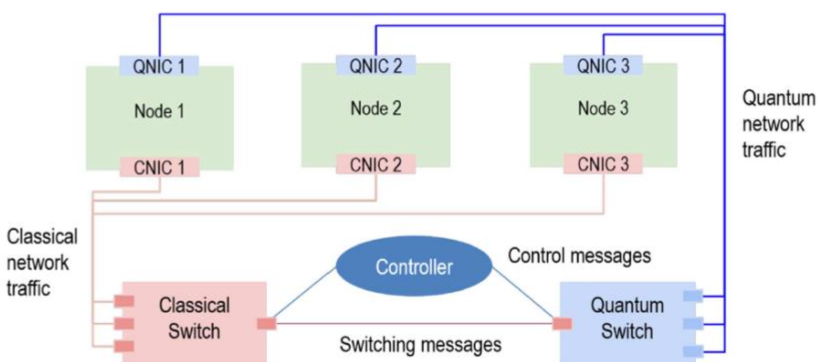
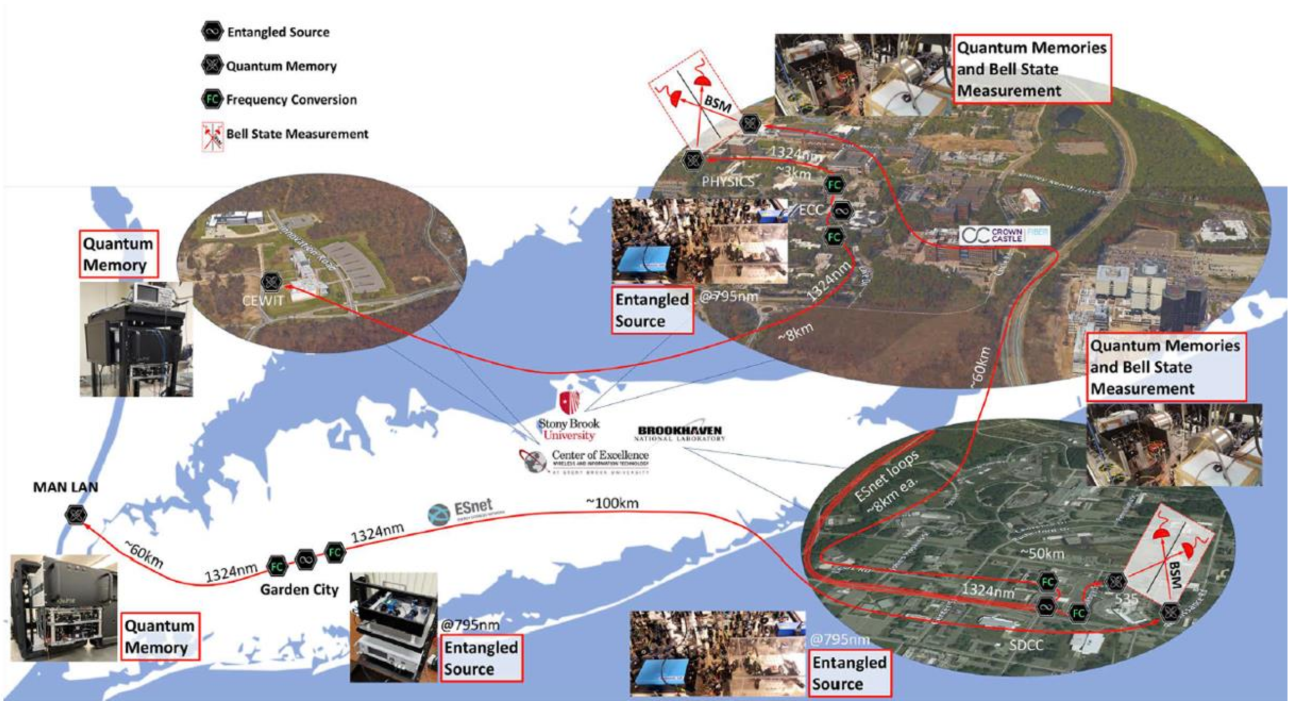


Diagram of a quantum network with three-nodes
From: Report of the DOE Quantum Internet Blueprint Workshop

The figure below shows an existing quantum network on Long Island, NY that will use BNL and intermediate stations in Garden City as it expands to connect Stony Brook University to New York City. This would be the start of a quantum-protected network extending across the U.S.



This project in New York State is expected to be the first quantum repeater network in the world. It will have a series of quantum repeaters extending from New York City to Long Island.
From: Report of the DOE Quantum Internet Blueprint Workshop

DOE is delving into other types of technology as it embarks on the next step in future computing with its investment into research that will advance neuromorphic computing. Neuromorphic computing is thought of as a "neural-inspired system" in that the computing components are inspired by biological neurons and synapses modeled after the human brain, to which the ability to adapt and learn is incorporated. DOE is interested in neuromorphic computing for its potential in HPC systems – supercomputers. DOE and other Federal agencies (such as NIST, NSF, DOD, and the IC) are working on developing these future cutting-edge computing-related technologies that will bring innovative solutions.

STEM & Workforce Corner: Building a Quantum Workforce

Quantum principles provide a new way to process information using quantum mechanics, computer science, and information theory. As we have alluded to above, QIS galvanizes science and technology in new ways with quantum computing, quantum communication, quantum sensing, and other breakthroughs on the horizon. To address the need to cultivate a quantum workforce, the NSTC QIS Subcommittee and NSF convened a **workshop** to gather key concepts for QIS educators and learners that will lead to further QIS educational activities and advance QIS curriculum at all levels. The ***Key Concepts for Future QIS Learners*** report identified nine key concepts that can broaden engagement and perspective with QIS while serving as a framework to expand educational opportunities.

To develop and support this upcoming technology, e.g., quantum computing and quantum internet, the **OSTP, the National Quantum Coordination Office, and NSF** are leading U.S. efforts to advance QIS through a **National Q-12 Education Partnership**. This public-private partnership brings together the tech industry, academics, scientific professional societies, and government agencies to spark interest in innovative technologies and drive educational opportunities at all levels that will lead to a diverse quantum workforce. To achieve the goal of a savvy quantum computing workforce, **NSF is investing almost $1 million dollars in QIS education** with grant programs targeted at boosting QIS knowledge in **high school educators**, fostering an understanding of QIS concepts in **middle school teachers**, and introducing industry-relevant computational thinking skills to **PreK-12 students**. "Quantum information science is a critical industry of the future where America must lead the world, and yet students don't typically learn about QIS until college," noted Michael Kratsios, the U.S. Chief Technology Officer, in explaining why this initiative is so important. "Through strong public and private sector commitment, we look forward to advancing our Nation's workforce and leadership in this key emerging technology".

Innovation Through NITRD Coordination

Interagency Working Group Corner: High End Computing (HEC)

Federal R&D investment in emerging technologies is critical to promoting and protecting American innovation and international leadership. The NITRD Program focuses its work on strategic R&D imperatives, in part because development of leading capabilities in cutting-edge technologies is intensely competitive globally. NITRD supports IT R&D activities across Federal agencies to help facilitate the transition of advanced networking and IT R&D into practical use. To do this, NITRD's IWGs coordinate activities with participating Federal agencies on topics that support the Administration's IT priorities.

Computing Terminology

Quantum computing – As we know, a regular computer stores information as 0's or 1's called bits. A quantum computer also stores information this way but it can also store as 0 **and** 1 at the same time ("superposition"). It can do this because in the quantum realm, a particle can have two different states, e.g., up and down. Information is stored as qubits, instead of bits. To perform a function, quantum computing uses a group of qubits that are designed to interact with each other. Unlike classical bits, it is not possible to copy qubits and attempts to do so can be detected. Quantum computing may not operate solely on its own. Instead, we may use a combined system in which, classical computing is used for part of the problem we are trying to solve and quantum computing for the more challenging elements.

Neuromorphic computing – This type of computing uses a brain-inspired silicon chip to mimic neuro-biological architectures. Neither the brain nor neural computers can connect every neuron/node, but rather they use a hub-and-spoke equivalence for better scaling, i.e., complexity. In the real world, numbers are not usually 0's and 1's and future computing architecture needs to be able to handle this.

Probabilistic computing – This type of computing aims to tackle ambiguity and learns from experience to interpret data. To do this, inference algorithms and simulation-based approaches to modeling are used. In comparison, traditional computing performs large numbers of high-precision numerical operations but is poor at working with ambiguous or incomplete input.

Moore's Law – This Law proposes that every two years the number of transistors on an integrated circuit will double. It has been suggested that computer chip performance would therefore double every 18 months. This became a goal of the semiconductor industry and has broadly been responsible for 55 years of rapid advances in computing.

HEC is the IWG that coordinates Federal agency R&D activities on future computing technologies, supercomputers, exascale capabilities, and extreme-scale computation and simulations. A strategic priority for HEC is to take computing "beyond Moore's Law" to new directions with quantum, neuromorphic, and probabilistic computing. HEC also coordinates the government's efforts to develop algorithms and applications for technological innovations, such as early-stage research of advanced technologies. Investments also provide academia, industry, and government researchers access, in terms of computing hours, to the most powerful computing platforms on Earth – the U.S. supercomputers.

What's Happening Corner: Event Highlights

The NITRD HEC IWG was directly involved in both the FC-COI meeting and the FTAC on Strategic Computing's subsequent report, ***Future Computing Community of Interest Meeting of August 5-6, 2019***, which is available to the public. At the Supercomputing Conference 2019 (SC19) **Birds of a Feather U.S. Strategic Computing – An Update** session (see photo below) on November 20, 2019, the FTAC co-chairs provided an update on FTAC recommendations to advance strategic computing. At the session, they opened the floor for dialogue with the strategic computing community to address the next steps that will sustain U.S. leadership in the computing ecosystem.

NITRD Staff Corner: Getting to know your NITRD staff

The NITRD Program recognizes its "small but mighty" three-person IT team for their extraordinary contributions to the NITRD Program and the National Coordination Office. The team has consistently stayed conversant on the emerging technologies that will enhance the networking infrastructure and communication capabilities of the NITRD Program. When the COVID-19 pandemic struck, the NITRD Program responded rapidly to the changing needs of interagency coordination and its 15 working groups.

Director Kamie Roberts with NITRD's IT team (left to right): Chris Nemr ('master' of all IT hardware), Jacob Dienger (2019 IT intern), Fouad Ramia (IT Manager), and Adrian Baranyuk (web 'guru')

The IT team put in place new technology platforms to allow NITRD's 23 member agencies and over 50 participating Federal departments and agencies to engage in virtual meetings and collaborate on documents in real-time. The IT team knows that teleworking is a work in progress, so they prepared a list of best-practices and held training sessions to get all participants comfortable with the technology platforms (e.g., video conferencing systems). They also remained committed to keeping information safe and secure without being too restrictive or getting in the way of being able to collaborate effectively.

Everyone at NITRD appreciates the excellent support of its knowledgeable and hardworking IT team. However, NITRD'S IT team often goes above and beyond supporting NITRD's staff and member agency representatives. The NITRD Program and the NCO were tasked by OSTP to develop two IT websites that broadcast guidance on emerging topics. One, the NITRD **COVID-19 webpage** increased online visibility of important COVID-19-related IT information, which included resources such as instructions for implementing the new **schema.org** tags. These tags are used in publishing and disseminating information related to COVID-19 and associated activities by NITRD's member agencies. The other website features information on the **National Quantum Initiative**, a coordinated effort among Federal agencies to accelerate quantum research for the economic and national security of the United States.

Agency Names & Other Abbreviations

AI	Artificial intelligence
ANL	Argonne National Laboratory
ASCR	Advanced Scientific Computing Research program
BNL	Brookhaven National Laboratory
COI	Community of Interest
DARPA	Defense Advanced Research Projects Agency
DOD	Department of Defense
DOE	Department of Energy
ECI	Exascale Computing Initiative
ECP	Exascale Computing Project
FTAC	Fast-Track Action Committee
HCIA	High-Capability Computing Infrastructure and Applications
HEC	High-end computing
HPC	High-performance computing
IC	Intelligence Community (a group of U.S. government intelligence agencies and subordinate organizations)
INL	Idaho National Laboratory
IT	Information Technology
IWG	Interagency Working Group
LBNL	Lawrence Berkeley National Laboratory
LLNL	Lawrence Livermore National Laboratory
LANL	Los Alamos National Laboratory
ML	Machine learning
NASA	National Aeronautics and Space Administration
NIST	National Institute of Standards and Technology
NNSA	National Nuclear Security Administration
NQI	National Quantum Initiative
NSF	National Science Foundation
NSTC	National Science and Technology Council
ORNL	Oak Ridge National Laboratories
OSTP	Office of Science and Technology Policy for the White House
PNNL	Pacific Northwest National Laboratory
QIS	Quantum Information Science
QIST	Quantum Information Science and Technology
R&D	Research and Development
SRNL	Savannah River National Laboratory
USN	United States Navy

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Who is NITRD and What is the Program?

The NITRD Program is the Nation's primary source of federally funded R&D on networking and information technology. The NITRD Program seeks to maximize interagency coordination in providing the R&D foundations for continued U.S. technological leadership and meeting the needs of the Federal Government for advanced IT.

Now in its 29th year, the NITRD Program is one of the oldest and largest of the formal Federal programs that engage multiple agencies in R&D coordination activities. It was established by the High-Performance Computing Act of 1991 (P.L. 102-194) and reauthorized by Congress in the American Innovation and Competitiveness Act of 2017 (P.L. 114-329). The NITRD Program provides a framework and mechanisms for coordination among the Federal agency members that support advanced IT R&D and report IT research budgets in the NITRD crosscut. Many other agencies with IT interests also participate in NITRD activities. More information is available about the **NITRD Program here**.

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Networking and Information Technology Research and Development
National Coordination Office

490 L'Enfant Plaza SW, Suite 8001
Washington, DC 20024

Phone: 202.459.9674
E-mail: nco@nitrd.gov
Website: www.nitrd.gov