

Hewlett-Packard Company (HP) appreciates the opportunity to provide our point of view on the formation of a National Big Data Research & Development (R&D) Strategy. Invention and innovation are heritage values for HP. Today we're investing more in R&D than ever before, as evidenced by our yearly investment of over \$3 billion in R&D, and our portfolio of over 36,000 patents. Combining the research of HP Labs with the advanced development capabilities of our business units, we are rapidly commercializing our ideas.

HP's view of big data—from an R&D perspective—sees a world facing a data explosion that is complex and is challenging to navigate and manage. The demand for computing is quickly outstripping the capability of many organizations' underlying technology. HP's focus on innovation is to bring advancements across the spectrum of business technology to tame the challenges of big data. This includes R&D in infrastructure, software and innovative processes that effectively enables storage, processing, and security of all types of the information coming at us—structured, semi-structured and unstructured. Our approach is to breed new solutions for enterprises to gain an advantage by driving toward relevant information that is going to drive actionable intelligence.

HP considers the **transformation of computing** among the most high-impact ideas at the frontiers of big data R&D. It is vital to take the deluge of data and find the fastest, most secure and efficient route for gaining real value from that data. We are heavily committed to addressing this problem. One significant project—called The Machine—is a multi-year, multi-faceted research program that aims to fundamentally redesign computing to handle the enormous data flows of the future.

This initiative builds on research in which HP Labs already leads the world—from storing, managing and processing data, to being able to analyze and mine it to gain meaningful insights at the right time, for improved business outcomes. With one output called Moonshot, we've created system-on-a-chip packages that combine processors, memory, and connectivity. In our photonics research, we're using light to connect hundreds of racks in a low-latency, 3D fabric. Our work in Memristors points to the development of universal memory—memory that collapses the memory/storage hierarchy by fusing the two functions into one hyper-efficient package. And we are breaking new ground in how massive volumes of diverse data can be analyzed, visualized, understood and converted into actionable intelligence by anyone in real-time. HP is building new software-defined systems that will fuse memory and storage, flatten complex data hierarchies, bring processing closer to the data, and enable security of systems at the point of attack. We're also shaping the future of cognitive computing by making processing available on a massive scale to improve human decision-making.

The purpose of tackling big data technology is to advance the outcomes of everyday business processes, as well as confront the tough problems that make a real difference to citizens and the environment. These are enabling scientists to collaborate on big data for medical research helping Veterans to receive the best care in the most efficient manner, protecting citizens in emergency situations, and understanding the impact of environmental changes to impacting our wildlife ecosystem. HP's philosophy is to create technology and services that “Make it Matter”.

HP considers *The National Big Data R&D Initiative: Vision and Priority Actions* draft document comprehensive, in that it contains key elements warranting serious consideration by NITRD agency leaders. HP concurs that streamlined access to relevant data sets and resources, development of partnerships that span private and public R&D sectors, actionable shaping of next-generation educational programs, and creation of gateways that enable the sharing of ideas and capabilities are indeed critical to enabling the Program's vision.

We encourage the NITRD Program to consider incorporating several additional foundational elements to its national big data R&D framework, to include facilitating and nurturing **communities of interest**, the formation of **accessible platforms**, and sponsorship of big data R&D **workforce retention** initiatives.

- The concept of community has always been at the heart of research. We envision immense value can be achieved by fostering a national hub that facilitates and incentivizes the creation of communities of interest around federal big data R&D priorities. This initiative—leveraging knowledge management at its core—would serve to “match experts” and “match projects” in order to accelerate sharing and knowledge to realize further advancements. In fact, technology can be applied to assist in this effort and at HP we have piloted a capability to leverage contextual information being shared in the enterprise to identify expertise across our technologists to foster community and collaboration to solve problems. We suggest such an activity would be enabled by the creation of a national big data R&D registry that includes each project's methodology, metrics and data-driven results.
- We believe research into new approaches, models and technology, and the application of those tools to federal mission challenges, could be facilitated by establishing common experimental platforms. There, multiple agencies could collaborate on exploring and testing new big data technologies and models without upfront capital investment and could be a springboard for enhanced collaboration. This could also reduce the “data” footprint by establishing a forum for large data sets and reduce data “churn”. Through supported platforms, we envision that the NITRD Program and private industry together could devise incentives for industry to contribute innovations and partner in the development of transformative solutions.
- Today, Data Scientists are in great demand and will continue to grow. We anticipate NITRD agencies are considering a variety of means within their authorities to retain such valuable staff, spanning compensation and benefits, continuing education, and unique mission experiences. NITRD should continue to encourage public programs and certifications for key roles for a data-driven organization. We envision the NITRD Program complementing agency initiatives by offering challenging and interesting projects, internal government competitions and prizes, and other opportunities for these employees to share successes and failures with motivated peers.

HP is an industry pioneer and global leader in the information technology market with a broad and deep portfolio of capabilities. We invest over \$3 billion in R&D each year and have hundreds of dedicated researchers who are looking at emerging trends to understand where our world is headed. We are inspired by the opportunities because we know what the power of creative thinking and technology can do to transform lives, businesses, and communities. For further information please contact Jeff Graham at jeff.graham@hp.com or 703-896-0932.