

Response to NITRD Request for Input.

Networking and Information Technology is among the most pervasive and profound technologies affecting all aspects of scientific, societal, as well as economical advances. Establishment of a national/international strategic plan is timely and much needed. We believe that NIT's impact is no longer confined in first generation applications such as voice/data/video transmission. An NIT infrastructure to support the next generation application will be most beneficial and significant in the decades to follow.

Description of Information Sought:

What do you imagine as the future in terms of desired NIT capabilities?

- NIT is expected to provide ubiquitous and secure information communication capabilities for real-time applications in a massive scale. First generation applications such as voice, data, and video transmissions have already impacted global economy in an unprecedented scale. The use of NIT in network control is just emerging but will have significant consequence in our way of living. Second generation applications include real time network control of factories, land/sea/air vehicles, hospitals, farm, entertainment etc. In order to support such a generational leap of advanced network infrastructure a theoretical development and commercialization advancement must be processed in coherent and synergistic manor This is possible only with significant national investment and leadership. Furthermore, the future technological development must include broad based market impact, to avoid any digital-divide type of deficiencies.

What roles do you imagine for the NITRD Program and for the academic, commercial, international, and other domains in achieving that future?

- NITRD program should establish cross agencies, international collaborations among university, industries, and federal research laboratories for several high priority applications. For such a complex process, the strategic vision must include a roadmap jointly developed by government, academia, and industry. Furthermore, program development should be an international effort with inputs from all stakeholders to maximize the benefit and minimize replication. The highest priority as we see it is the definition of standards. While NIT is evolving and maturing, a shift from spontaneity to guided development should occur. At present, there are numerous hardware, software, and implementation protocols. The transition into a new generation of technology is not a smooth process and, thus, the lack of standards can be very detrimental.

In addressing these questions, submitters are challenged to present views and input on one or more of the following subjects, in relation to NIT:

Development and execution of multi-agency and multi-disciplinary programs

- It is envisioned that NITRD acts as a broker and a facilitator to arrange workshops, symposium, portals, funding, initiatives in order to successfully fulfill the vision. Besides offering programmatic initiatives, NITRD should encourage industry-led projects and multi-national projects. The latter is especially significant as presently, multi-national research projects are difficult to fund, set-up, and execute.

Determination of strategic goals, key challenges, opportunities, and research priorities

- NITRD needs a strong industry component. However, industry participation is a very difficult factor to quantify; as the experience in NIST Advanced Technology Projects had demonstrated. Nevertheless, a mechanism must be set up to encourage industry to

participate whole heartedly by transforming industry from a technology receiver to an active member. The key metrics for evaluation of success and the traditional proposal evaluation process must be broadened.

Examples that illustrate the impact of realizing the vision, achieving the proposed goals, and meeting the identified challenges

- Example 1: Integrate global resource challenges to solve high priority issues (e.g., pollution, energy crisis) in the world that cannot be solve otherwise.
- Example 2: Establish a massive ubiquitous and secure information communication network for real-time transportation applications. Every single vehicle on the road could interact with their neighbor vehicles, as well as connect to local base stations. The local base stations are connected to the central station. The central station will coordinate with base stations to perform real-time analyses on the traffic conditions, perform real-time optimization using distributed computing, and inform each vehicle the optimal route (e.g., minimal traveling, minimal energy, minimal CO₂ emission, and improved safety) they should select based on the information provided from each vehicles' on bord electronics, e.g., GPS. Many of these concepts have already been used and some are commercially available for individual cars. This individual optimization certainly will not lead to globally optimal results. However, by tasking all of the vehicles and infrastructure to create a real-time and globally optimal solution would be relatively basic; yet the payback would also be substantial. Combining this technology with congestion charging infrastructures / cities will provide opportunities for consideration research and environmental improvements.

Transition of R&D results into practice

- Success of R&D transition depends on a number of factors: industry involvement in basic research phase, academic involvement in the deployment phase, and government involvement in all phases. It should be noted that the transition process must be done with a global mindset.

Role of the U.S. in the international NIT arena

- The NIT arena is increasingly competitive in the first generation applications. To maintain leadership, focused innovation is the key. With its prowess in basic research, creativity, and infrastructure, the United States should take on the leadership role. We should learn and actively involve other partners in terms of research, development, and manufacturing. NITRD is encouraged to generate centralized information clearing house and an office to assist the assembly of such information.

Interactions among government, commercial, academic, and international sectors

- Traditionally, government financial support has been a strong catalyst for interactions. For the scale of NIT, many other issues such Intellectual Properties (domestic and international), international regulations/arbitration, etc. must be resolved. Multi-national corporations' experience can be a helpful input to this process.