Information and Communication Technologies (IC)
Proposal Due Date: December 3, 2010

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Administrative Information

The required 400-word project summary should discuss the intellectual merit and broader impact in two separate ~200 word paragraphs that specifically answer the following questions: Paragraph 1) Intellectual merit: What is the problem to be solved? How will the problem be solved? What is the innovation in the proposed approach? Paragraph 2) Broader Impacts: Why is your solution better than competitive technologies? Who is going to buy your solution? Who are the other key players? If these answers are not addressed, the proposal may be returned without review.

Proposals must address the potential for commercialization of the innovation and how it would lead ultimately to revenue generation. It is important that the proposed technology increase the competitive capability of industry, be responsive to societal needs, and is sensitive to solving "real" problems driven by critical market requirements. There is considerable overlap between the subtopics and proposers should pay attention to the areas indicated under each subtopic to assist the program in placing these proposals on review panels.

Letters of Support for the Technology

Inclusion of letters of support for the technology within the proposal is strongly encouraged for proposals being submitted to this solicitation. Letters of support act as an indication of market validation for the proposed innovation and add significant credibility to the proposed effort. Letters of support should demonstrate that the company has initiated dialog with relevant stakeholders (potential customers, strategic partners, or investors) for the proposed innovation and that a real business opportunity may exist should the technology prove feasible. The letter(s) must contain affiliation and contact information for the signatory stakeholder.

Importance of Communication with Program Officer

A company considering a proposal submission is encouraged to communicate (via email) with the cognizant program officer to help gauge the responsiveness to the solicitation (the cognizant program officer is indicated at the end of each subtopic). When contacting the cognizant program officer, please provide a brief one page executive summary with background on the: 1) company/team including experience with previous SBIR awards, 2) market opportunity, 3) technology/innovation and 4) competition. You may contact the program officer via email at any time before the submission deadline. Note, however, that communication with the program officer will become increasingly difficult as the deadline nears.

Electronics, Information and Communication Technologies (IT)

The National Science Foundation (NSF) Small Business Innovation Research (SBIR) program seeks state-of-the-art, high-risk, high-potential innovation research proposals in the area of Electronics, Information and Communication Technologies. These proposals should seek to provide economic and technological benefits that will motivate their successful adoption in the commercial marketplace.
The NSF SBIR Program conceptualizes Electronics, Information and Communication Technologies in the form of a five-layer stack. Each layer of the stack builds upon the layer(s) below and supports the layer(s) above. At the foundation of the IT stack are devices. Devices (I5) are the building blocks for Components (I4) that are assembled into Systems (I3) built for Applications (I2) that are employed to deliver Services (I1). Innovations across the IT stack can range widely and hardware as well as software innovations will be supported. Considering the two ends of the stack, device innovations will typically employ unique physical phenomena for their competitive advantage and be embodied in hardware, whereas innovations in services will typically be more architectural in nature and be embodied in software.

Proposals must address one of the subtopics that are outlined below. Proposals that are not responsive to the subtopics outlined below will be returned without review. When submitting a proposal to the IT Topic, code the proposal to the corresponding subtopic under which you are submitting the proposal, e.g., I3e for proposals in the area of "Robotics". In addition, use the code as the first item in the key words/phrases portion of the Project Summary of your proposal.

I1. Services

Enterprises large and small, for-profit and non-profit, must respond to customer needs, manage internal activities, and adapt to competitive market pressures much more rapidly than at any other period in human history. Enterprises that effectively and efficiently combine computing, communication, services and business process advances become leaders in their respective markets. These developments have created significant commercial opportunities for software that support the following areas: Errol Arkilic (earkilic@nsf.gov)

- I1a. Security and privacy
- I1b. Knowledge discovery, search, data mining, data management and/or visualization
- I1c. Digital arts
- I1d. Financial services
- I1e. Personalized user services
- I1f. Virtualization

I2. Applications

Advancements in applications provide value by enabling increased user productivity or enhanced quality of life. Examples of previous innovations in applications include: the spreadsheet, email and web browser. Software innovations (for both consumer and enterprise applications) that enable significant business opportunities in the following areas will be supported under this solicitation: Errol Arkilic (earkilic@nsf.gov)

- I2a. Mobile applications
- I2b. Tools for facilitating collective intelligence
- I2c. Peer-To-Peer applications
- I2d. Broadband-enabled applications
- I2e. Collaboration-enabled applications
- I2f. Component/devices design/test software

I3. Systems
Systems’ innovations combine multiple sub-elements and components together to enable the delivery of new value. Examples of previous systems innovations include the MP3 player, the artificial heart and the radio telescope. Software and hardware that enable significant, differentiable business opportunities in the following areas will be supported under this solicitation:

- **I3a. Human Computer Interaction**: Errol Arkilic ([earkilic@nsf.gov](mailto:earkilic@nsf.gov))
  - Applications employing speech, touch, vision or biometric technologies
  - Spoken language systems - conversational dialog management, semantic language analysis or interpretation

- **I3b. Virtual/mixed reality environments**: Errol Arkilic ([earkilic@nsf.gov](mailto:earkilic@nsf.gov))

- **I3c. Human assistive technologies**: Murali Nair ([mnair@nsf.gov](mailto:mnair@nsf.gov))

- **I3d. Wireless systems**: Murali Nair ([mnair@nsf.gov](mailto:mnair@nsf.gov))
  - Reconfigurable wireless systems
  - Minimal interference, graceful degradation wireless systems
  - Hardware solutions to security in wireless systems
  - Ultra-compact, low cost systems
  - For advances in healthcare delivery
  - Sensor based systems
  - Broadband systems
  - Nanotube RFID

- **I3e. Robotics**: Murali Nair ([mnair@nsf.gov](mailto:mnair@nsf.gov))
  - Improved time imaging, visualization, dexterity and manipulation
  - Haptic, real-time and bio-inspired feedback
  - Semi-autonomous tele-robotics
  - Naturally inspired, biomimetic, neuromechanical robotics
  - Precision agriculture robotics
  - Robotics in healthcare (robotic prosthesis, robot-assisted rehab, miniature robotics, high throughput technologies – imaging, screening of drugs, surgical procedures)
  - Concepts for protecting human hands (in various extreme environmental conditions)
  - Robotics in agile manufacturing
• I3f. Energy and Power Management Systems: Murali Nair (mnair@nsf.gov)
  o Electronic systems for energy efficiency
  o Portable energy sources for mobile technologies
  o Portable energy sources for off-grid type applications
  o Energy Scavenging/harvesting and its power management
  o Smart grids, buildings and circuits
  o Compact energy conversion systems
  o New storage technologies – e.g. super- and ultra-capacitors
  o Interface devices between batteries and super-capacitors
  o Novel voltage conversion, micro-inverters and DC-DC voltage converters
  o Compact, hi-voltage, hi-power systems

• I3g. Test techniques to improve chip design and manufacturability: Murali Nair (mnair@nsf.gov)

• I3i. Scientific Instrumentation: Juan Figueroa (jfiguero@nsf.gov)
  o Astronomical
  o Geophysical
  o Instrumentation in support of scientific and engineering research

• I3j. Optoelectronics: Juan Figueroa (jfiguero@nsf.gov)
  o Imaging and display systems
  o Plastic logic devices/displays
  o Superluminal computing
  o All-optical processing/computing
  o Novel application of hybrid systems

I4. Components

Components represent basic building blocks for most engineered systems. By themselves, components are not typically consumed by end-users and they must be assembled together with other components to
provide complete solutions. Examples of previous component innovations include: Micro-Electro-Mechanical Systems (MEMS)-based accelerometers, Sigma-Delta Analog to Digital Converters (ADC) and Optical Add-Drop Multiplexer (OADM). Hardware that enables significant, differentiable business opportunities in the following component areas will be supported under this solicitation:

- **I4a. Micro-Electro-Mechanical Systems (MEMS):** Juan Figueroa ([jfiguero@nsf.gov](mailto:jfiguero@nsf.gov))
  - High performance MEMS-enabled applications

- **I4b. Optoelectronics:** Juan Figueroa ([jfiguero@nsf.gov](mailto:jfiguero@nsf.gov))
  - Light generation
  - Lighting components
  - Light processing, control and transformation

- **I4c. Sensors:** Murali Nair ([mnair@nsf.gov](mailto:mnair@nsf.gov))
  - Sensor-based smart transportation
  - Environmental/chemical sensing
  - Electrical/magnetic/optical/physical sensors
  - Acoustic emission monitoring
  - Body-area sensors/actuators for real-time, closed loop health monitoring
  - Wireless sensors and wireless detection of sensor I/O

- **I4d. Packaging and thermal management:** Murali Nair ([mnair@nsf.gov](mailto:mnair@nsf.gov))

- **I4e. Radio Frequency (RF) components:** Murali Nair ([mnair@nsf.gov](mailto:mnair@nsf.gov))
  - Millimeter wave/terahertz technologies, applications and products
  - Ultra-compact, all-integrated RF components
  - THz RF components
  - Anti-counterfeiting labels/seals

- **I4e. Hardware solutions to cyber-threats:** Murali Nair ([mnair@nsf.gov](mailto:mnair@nsf.gov))

**I5. Devices**
Novel devices employ unique physical principles that enable broad advances in technology and industry. They often represent fundamental scientific and technological building blocks that require significant integration with other advanced technologies to provide commercial value. Examples of previous innovations in the device field include: the transistor, the thermocouple and Light Emitting Devices (LED). Hardware that enables significant, differentiable business opportunities in the following component areas will be supported under this solicitation: Murali Nair (mnair@nsf.gov)

- I5a. Light detection devices; novel photonic devices (light emitters; photo detectors); optical chips
- I5b. Novel device or chip architectures; self-assembling chips; dense ICs and high power electronics integration; transparent/flexible/molecular electronic devices; ultra low-power semiconductors; single-die integrated precision analog/dense digital; intelligent/adaptive-smart chips; ultra-high-power semiconductors; novel I/O; interfacing and galvanic isolation
- I5c. ICs with novel materials
- I5d. Quantum-effect devices; spintronic devices