Assimilation Dynamic Network (ADN), Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

The Assimilation Dynamic Network (ADN) is a dynamic inter-processor communication network that spans heterogeneous processor architectures, unifying components, significantly improving flexibility, efficiency, and overall usability. ADN has the following main features: - A uniform programming model for intra-platform communication among heterogeneous processing resources that creates a homogeneous programming environment. - A novel networking layer encapsulates and abstracts hardware resources (e.g. a mixture of multicore CPUs, FPGAs, ASICs) with a uniform communication method & format across the physical resources. - Extends memory resources and network connectivity to facilitate flexible, efficient partitioning and placement of functionality across the heterogeneous physical resources. - Enables gradual optimization during development and beyond, e.g. functions that initially ran on CPUs are moved to FPGA cores for optimization while still remaining in the same application software framework. Technical Objectives and Milestones for the Phase II project: - Establishing an ADN specification - Developing ADN libraries for HDL and C designs - Expanding hardware support for multicore CPU, FPGA and ASIC platforms - Developing tools to facilitate ADN designs - Demonstrating and evaluating ADN use in an example application - Releasing ADN libraries and tools

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA applications utilizing the ADN concept: - Software Defined Radio: ADN provides unmatched flexibility and performance in high-performance platforms for software defined radio with the ability to perform computations on the processor that handles them best. This could enable development of radios for space deployment or for terrestrial deployment with COTS parts. - ALHAT: Autonomous Landing and Hazard Avoidance Technology (ALHAT) requires advanced processing

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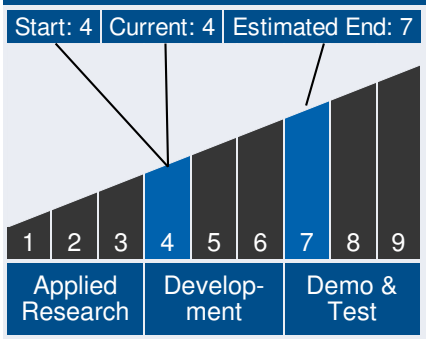
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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platforms for automated real-time control. - ISS Video Distribution System: Video processors on this platform could be used to upgrade the video distribution system on the ISS. They could be on board the distributed cameras, and they could also sit centrally within the station or on the ground as a decoder and post-processing system. - Hyperspectral Data Compression: An emerging need for NASA (and DoD), this compression not only reduces data volume in order to meet limited downlink capabilities, but also can improve signature extraction, object recognition and feature classification capabilities by providing exact reconstructed data on constrained downlink resources.

To the commercial space industry:

Potential Non-NASA applications utilizing the ADN concept: - Surveillance and Reconnaissance (SR), utilizing HD video and other high capacity sensors in airborne platforms (UAVs). As the importance UAVs has emerged for situational awareness and target recognition and tracking, the demand for processing has increased significantly, putting great pressure on processing resources. The branches of DoD together with US Customs & Border Protection and local law enforcements are likely customers SR applications. - Medical imaging is a field of vast expansion, demanding high performance, power efficient computing platforms with small footprint. - Data Center Acceleration: The ADN supports a unique way to reuse functions on both FPGAs and on ASICs that provide economy of scale for a data center provider, while still allowing uniquely customized processing solutions for their customers. Data centers are today targeting particular compute intense applications such as in the biotechnology, engineering and finance fields. - Helmet Vehicle Interface (HVI): This falls under the combat and trainer avionics market, with a projected strong growth rate. US Air Force and Navy are the main customers this field. - Software Defined Radar: ADN enables lower cost and increased scalability for software defined radar systems. The MDA has programs such as FBX-T (Forward-Based X-Band Radar-Transportable) that are seeking advanced radar solutions.

Management Team *(cont.)*

Project Manager:
- Thomas Flatley

Principal Investigator:
- Brandon Beresini

Technology Areas

Primary Technology Area:
Communications, Navigation, and Orbital Debris Tracking and Characterization Systems (TA 5)
└ Integrated Technologies (TA 5.5)
  └ Cognitive Networks (TA 5.5.3)
    └ Automated Intelligent Networked Systems (TA 5.5.3.1)

Secondary Technology Area:
Modeling, Simulation, Information Technology and Processing (TA 11)
└ Computing (TA 11.1)
  └ Flight Computing (TA 11.1.1)

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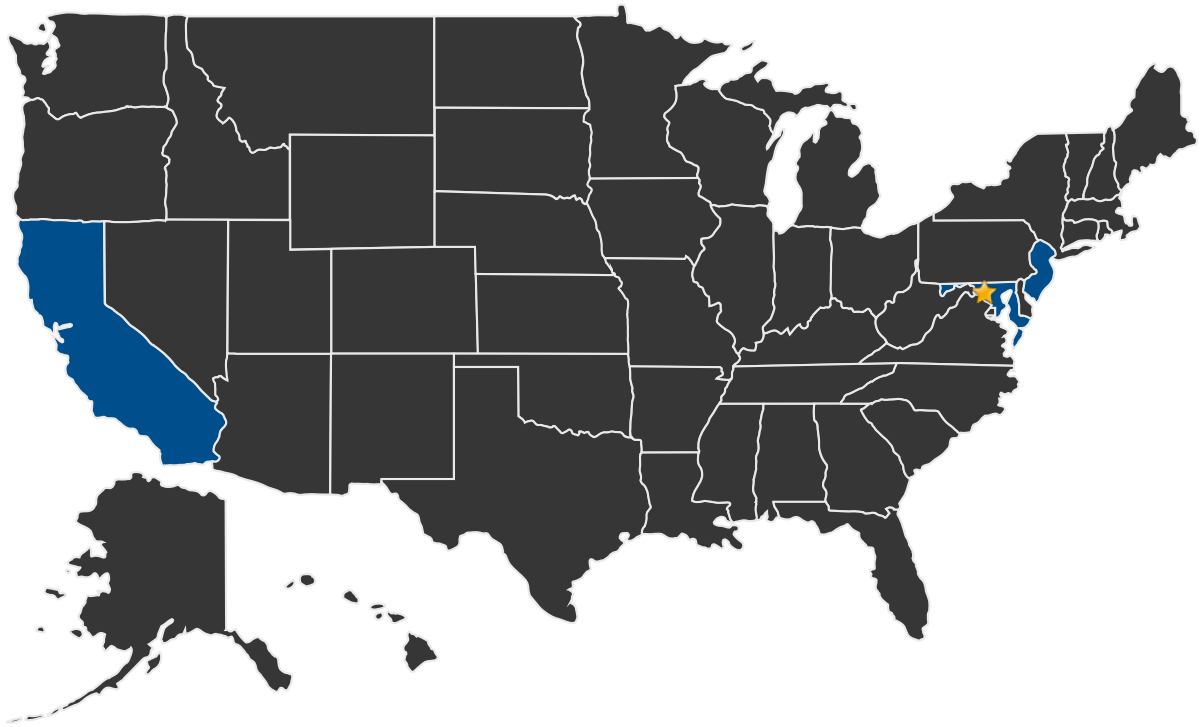
U.S. WORK LOCATIONS AND KEY PARTNERS



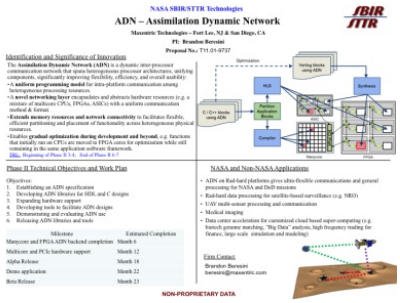
U.S. States With Work

Lead Center:
Goddard Space Flight Center

Other Organizations Performing Work:

- MaXentric Technologies, LLC (Fort Lee, NJ)
- The Regents of the University of California, San Diego (La Jolla, CA)

IMAGE GALLERY



Assimilation Dynamic Network (ADN)

DETAILS FOR TECHNOLOGY 1

Technology Title

Assimilation Dynamic Network (ADN)