Center for Integrated Access Networks (CIAN)

The University of Arizona (lead institution)

Creating transformative optical technologies to enable an affordable, faster internet for the future

A National Science Foundation Engineering Research Center since 2008

Partner Institutions:

- *California Institute of Technology*
- *Columbia University*
- *Norfolk State University*
- *Stanford University*
- *Tuskegee University*
- *University of California, Berkeley*
- *University of California, San Diego*
- *University of California, Los Angeles*
- *University of Southern California*

The Center for Integrated Access Networks (CIAN), an Engineering Research Center (ERC) headquartered at The University of Arizona, is focusing on removing one of the last bottlenecks in the Internet by developing optoelectronic technologies for high-bandwidth, low-cost, widespread access and aggregation networks. The vision of CIAN is to create the "PC" equivalent for the optical access and aggregation network. It entails transforming the costly, discrete optoelectronic technologies of today's network into affordable, highly integrated optoelectronic subsystems that demonstrate novel optical network functionalities and infrastructure, enabling heterogeneous services.

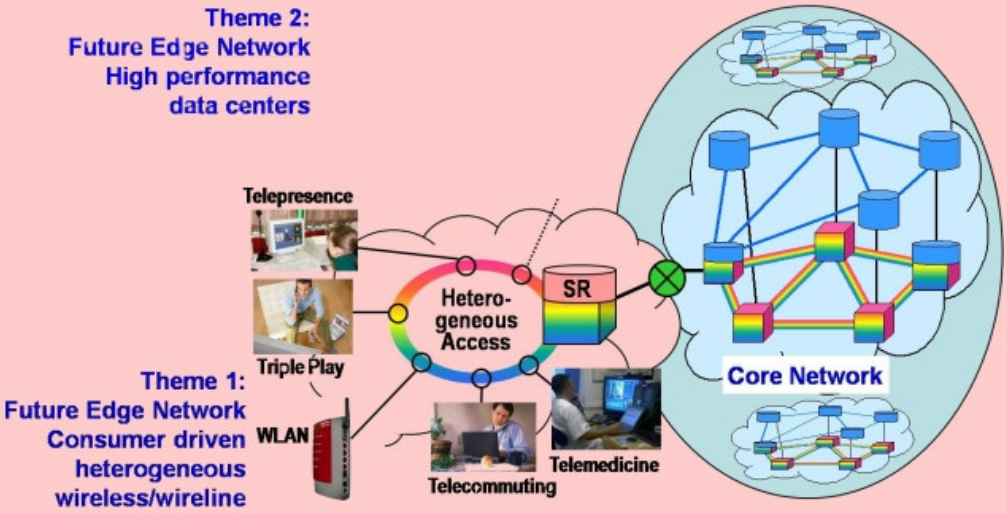
CIAN's ultimate goal is to provide the technological foundation for an advanced optical network that simultaneously achieves efficient high data rate aggregation, amortizing the cost for end users, while providing the necessary flexibility to support diverse end-user requirements. The development of these technologies is essential for delivery of single-user data rates approaching 10 Gb per second and provision of the associated services to a broad population base, regardless of the "last-mile" technology. Attainment of this goal will enable affordable, flexible access to any type of service to anybody, anywhere, at any time.

Research

The research of the CIAN ERC will advance across three major thrusts wherein interoperability of components will be proven via state-of-the-art testbeds, which will provide for cross-collaboration among system, sub-system, and device research efforts.

Thrust 1: Optical Communication Systems and Networking will act as the "top-down" driver for the development and integration of components and devices that will enable integrated subsystems, co-optimized to cost-effectively provide high-data rate services to the "curb." This thrust includes issues such as aggregation and access networks, cross-layer optimization, wavelength multicasting, and ubiquitous monitoring. The projects in this thrust will enable and demonstrate numerous new network applications including ultra high-bandwidth data centers and immersive telepresence.

Thrust 2: Subsystem Integration and Silicon Nanophotonics will explore signal conditioning, processing, reconfiguration, and control functions realized with various platforms including CMOS-compatible nanostructures and silicon nanophotonics, as well as multifunctional integrated subsystems exploiting monolithic and heterogeneous integration.



Thrust 3: Materials and Devices will act as the scientific and technological foundation by conducting research on new materials, device technologies, and processing and integration methods for chip-scale integrated optoelectronics.

Education

CIAN's Education and Outreach programs include:
(1) creating vertically integrated (from pre-college to post-graduate) curricula which are team-based, research-inspired, and industry-oriented;
(2) promoting cross-disciplinary, diversity-oriented approaches to education for university researchers, college students, K-12 students, teachers, and the general public;
(3) educating a skilled and diverse workforce to lead the next-generation communications industry; and
(4) integrating engineering, technology, and business education into the knowledge base of CIAN's students to stimulate technology transfer.

The Center is developing new programs of outreach, creating internship/ mentoring programs, and developing assessment and tracking processes for the education program.

Industry Collaboration / Technology Transfer

CIAN's Industrial Collaboration and Technology Transfer Program will be involved in all aspects of the ERC: strategic planning, supervision of and collaboration in research projects, operation of testbeds, mentoring of students and post-doctoral fellows, and education. The goals of the Industrial Collaboration and Technology Transfer Program are to provide: (1) an industrial voice in the management of the Center, (2) industrial guidance in the selection and emphasis of research projects, (3) an avenue for technology transfer from the Center to industry, and (4) a path for industrial support of and participation in educational programs. To accomplish these goals, the CIAN ERC encourages the participation of large and small companies as collaborators in research, product development, education, and commercialization. Industry sectors interested in CIAN's technologies are telecommunications, network equipment, aerospace, semiconductor, test & measurement, and optical component manufacturers and developers.

Facilities

CIAN's main operations are located at The University of Arizona's College of

Optical Sciences, which provides resources for both theoretical and applied research programs in all areas related to optics and the optical sciences. The Center headquarters is on the 5th floor of a 47,000 square-foot West Wing addition, completed in 2006.

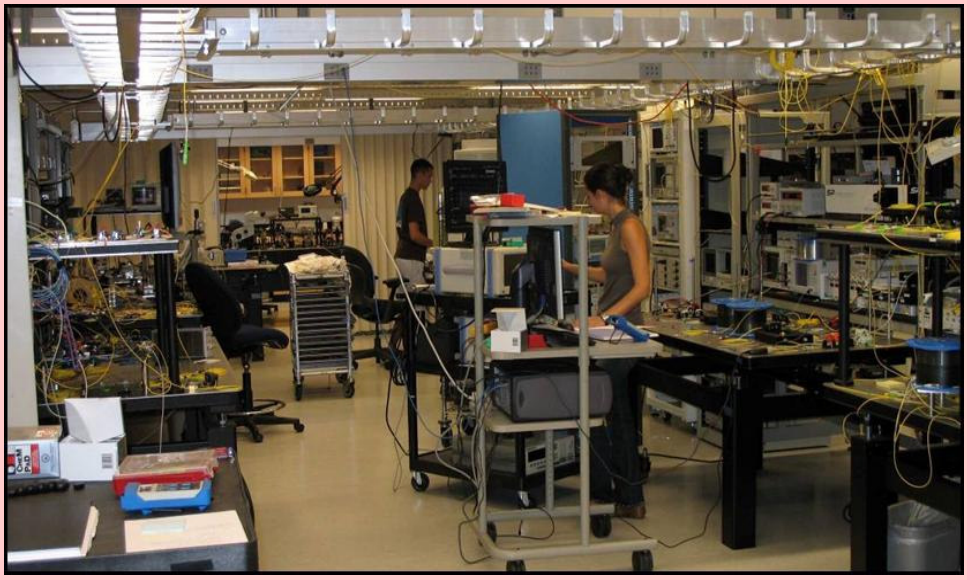
The CIAN Grand Challenge Testbed, located on the campus of UCSD, is a shared research facility where CIAN's research from the various thrusts is integrated, enabling collaborative research among CIAN participants and with the wider research and industrial community. UCSD's Calit2 information technology facilities, including contiguous laboratory space and unique test capabilities, are at hand to assist in achieving CIAN's testbed vision, which is to:

- Provide a vertically integrative cross-thrust platform for testing CIAN technologies in a more system-driven environment than individual academic laboratories offer.
- Enable measurement of key metrics for potential applications.
- Identify to CIAN researchers the key limitations and technology specifications that require improvement.
- Foster collaborations with industry and showcase CIAN technologies.
- Provide a unique educational environment for training graduate, undergraduate, and K-12 students.

The CIAN testbed allows for measurement of device-specific parameters. Moreover, the CIAN testbed allows system-level testing of data transmission impairments, power penalty, polarization effects, bit error rate, aggregate capacity, reconfiguration time, network outage probability, and data blocking statistics. Equipment infrastructure that enables this detailed testing is available.

Center Configuration, Leadership, Team Structure

The University of Arizona (lead institution) and its partner institutions, the University of California at San Diego, the California Institute of Technology, Stanford University, the University of Southern California, University of California at Los Angeles, University of California at Berkeley, Columbia University, Norfolk



State University, and Tuskegee University form the CIAN ERC.

The CIAN leadership team is composed of researchers across disciplines in optical communication systems and architectures, optoelectronic subsystems and silicon nanophotonics, as well as basic materials and device research. This enables CIAN to conduct systems, sub-system, and basic research in the domains of optical access and aggregation for network data center and/or cross-layer optimization. Our leadership is structured to: select and direct research activities, manage the ERC's technical and other relationships among participants, enhance industrial participation, and foster intellectual property and commercialization of CIAN's discoveries.

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