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### Award Abstract #0946412

## CIAN's New Testbed for Optical Aggregation Networking (TOAN)

**NSF Org:** [EEC](#)  
[Div Of Engineering Education and Centers](#)

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**Award Number:** 0946412

**Award Instrument:** Standard Grant

**Program Manager:** Lawrence Goldberg  
EEC Div Of Engineering Education and Centers  
ENG Directorate For Engineering

**Start Date:** December 1, 2009

**End Date:** November 30, 2010 (Estimated)

**Awarded Amount to Date:** \$600,000.00

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**NSF Program(s):** EEC Innovation Awards

**Program Reference Code(s):** 130E, 132E, 7960

**Program Element Code(s):** 7960

### ABSTRACT

The new Testbed for Optical Aggregation Networking(TOAN) augment the capacity for innovation of the Center for Integrated Access Networks (CIAN), an Engineering Research Center, headquartered at the University of Arizona This testbed will synergistically complement the existing CIAN testbeds at the other CIAN partner universities: Columbia University ("cross-layer optimization"), at the University of Southern California ("optical data introspection"), and at the University of California, San Diego (main testbed for "transmission/processing" and planned extension for "data centers"). These test sites offer cutting-edge performance in their respective areas of specialization. The new flexible, multi-node, and heterogeneous traffic "network emulator" will provide much-needed networking-oriented testing capabilities for CIAN researchers as well as for affiliated

institutions and industry at very moderate cost. This benefit derives from the fact that TOAN is not designed for ultra-high transmission speed and data throughput, but rather for demonstrating and testing network functionalities. It will focus on a transparent aggregation domain with interfaces to residential access areas and data centers, to neighboring domains, and to the core/backbone.

The intellectual merit of TOAN lies in its unique approach of combining functionalities (transmission, processing, monitoring, control) that are currently spread out over multiple test sites within a unified laboratory-style, flexible, affordable, and manageable setting. Typical specifications for emulating a multi-node aggregation network have been derived in collaboration with CIAN industrial affiliates, whereby relevant targets have been set such as 6 nodes / 40G data rates / 200 km link lengths / 400 km ring length over heterogeneous transmission media with the need for adaptive impairment compensation and/or impairment-aware switching and routing. This platform will provide much-needed networking-oriented testing capabilities for CIAN researchers as well as for affiliated institutions and industry. These include. impairment-aware cross-domain traffic engineering and functionality tests of CIAN-built devices with respect to cascadability and network stability, to mention only a few of the features that CIAN industrial affiliates have suggested CIAN implement. This end-to-end network topology will allow for experimentation with the various trade-offs in the implementation of impairment compensation and switching in dynamic network settings.

The broader impact of the proposed new testbed is threefold: (a) Engineering research: The uniqueness of a lower-layer optical networking platform which provides emulation of network functionalities rather than the one-dimensional concatenation of transmission segments or the isolated demonstration of various processing tasks only. (b) Industry collaboration: As requested by the Site Visit Panel, TOAN will further stimulate collaboration with industry (matching industrial contributions demonstrate interest). (c)

Undergraduate Education: the testbed will be utilized to establish a semester-long, seminar-style "open lab" in order to attract incoming engineering freshmen to optical communications, to familiarize them with advanced network tests, and to recruit the best students as future CIAN undergraduate research assistants. The functionality of the testbed will be increased over time as new subsystems are introduced giving more ability to monitor and control various network configurations. Overall, the testbed will speed up the capacity of CIAN to provide practical and useful networking innovations for industry.

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