I-Light Cyberinfrastructure Plan (CI Plan)

Introduction
The goal of I-Light's CI Plan is to ensure that the advanced networking needs of I-Light researchers are met with the minimum of friction. This goal permeates through I-Light's operations, including its funding model, which effective discounts the fees for all traffic to/from research & education institutions. To meet this goal, I-Light manages a continuous process of needs assessment, infrastructure/capacity/financial planning, upgrade implementation, and operational support.

Needs Assessment
I-Light proactively engages its members through an annual member meeting, regular site visits (approximately 12 per year), periodic email communications, and direct staff participation in member infrastructure projects (i.e., campus expansion, backbone upgrade, etc.). I-Light also regularly reviews the performance of its backbone and connections to its members. This information is shared with members to inform their decisions regarding capacity and infrastructure planning.

Through this proposal, I-Light's needs-assessment approach will be transformed to include a multi-step process that engages I-Light member researchers and member CI champions (i.e., those who support CI on the local campus). This process is intended to increase the exchange of information concerning researcher needs and campus + I-Light capabilities. Bringing these campus constituents together, along with experts from Indiana's larger research institutions (e.g., Indiana University, Purdue University, etc.), for the purpose of ensuring the campus and regional networks are meeting current and near future needs, will allow I-Light's and the campus's CI Planning to provide the best possible compliment.

Infrastructure - capacity and financial planning
I-Light's backbone transport, as well as most of its members' local loops, is based on dark fiber, enabling I-Light the agility to respond to changes in capacity needs through the provisioning of new or additional hardware (e.g., lighting additional wavelengths, upgrading switches, etc.). Typically I-Light members are connected at 1Gb/s to the I-Light backbone.

Through its governance committees, I-Light annually reviews its backbone infrastructure and member services needs and capabilities, assesses the financial and operational impact of upgrades, and develops its next technology plan.

Through this proposal, I-Light anticipates as many as four institutions will accelerate their requirement for 10Gb connectivity, and additional institutions will increase their use of existing 1Gs connectivity. Fortunately, I-Light has the resources in-place to meet these new requirements in a timely fashion (i.e., in most cases upgrade can be implemented in a few days), and without service or other disruption.

Upgrade Implementation and Operational Support

I-Light's use of wave division multiplexing and modular routing and switching equipment allows for relatively quick and painless incremental upgrades to meet backbone and members' changing needs. Major upgrades, including migration to a 100Gb backbone, are more closely coordinated with its members. Through its close relationship with its members, I-Light's disruptive maintenance/upgrades schedules, as well as the urgency in which it responds to degraded service, are informed by the temporal needs of its members (e.g., class registration, final exams, etc.).

Through this proposal, I-Light will gain new relationships that extend directly to its members' researchers, informing its approach to network operations. Within the context of researchers' needs, slight service degradations (e.g., small fractions of a percent of packet loss) may need to be addressed as urgent. There may be scheduled research events, such as demos or long running computations, that inform maintenance schedules. Understanding head-room requirements can also improve capacity planning and interpretation of utilization data. In addition, this proposal expansion of the use of perfSONAR will provide a new tool for for the campus CI champion to collaborate with the GlobalNOC to diagnose and remedy network performance impairments.

Implementation of IPv6

I-Light supports native IPv6 throughout its network via a dual-stack approach. I-Light's IPv6 addressing plan is as follows:

IPv6 Address Allocations

The Indiana GigaPOP has a direct IPv6 address allocation from ARIN of 2001:18e8::/32. The GigaPOP delegates prefixes in the range of /40s through /48s to its members depending on the size of their networks. A member with a single campus may receive a /48 whereas a member with 8 campuses may receive a /45. Each GigaPOP member can in turn divide their prefix into a /48 for each campus and further into /64s for individual broadcast domains. (See RFC2374 and RFC3177 for guidelines on address allocation). It is expected that all suballocations are SWIPed to ARIN so that they are documented to the world. Because of the way v6 address space is aggregated, these delegated /48 addresses will (likely) not be accepted from end-sites and routed by other carriers and are not "portable." Allocations made so far by the Indiana GigaPOP for its internal use and to its members are:

Delegation	Site
2001:18e8::/36	GigaPOP Member Blocks
2001:18e8:0000::/44	Indiana University System
2001:18e8:1::/48	IUPUI
2001:18e8:2::/48	IUB
2001:18e8:3::/48	IUE

2001:18e8:4::/48	IUK
2001:18e8:5::/48	IUNE
2001:18e8:6::/48	IUSB
2001:18e8:7::/48	IUS
2001:18e8:0400::/40	I-Light
2001:18e8:0800::/44	Purdue University System
2001:18e8:0C00::/44	Other directly-connected gigapop members
2001:18e8:c02::/48	IPGrid (Bloomington)
2001:18e8:c03::/48	IPGrid (Indianapolis)
2001:18e8:ff00::/48	Indiana GigaPOP Internal

Prevention IP spoofing

The I-Light Network implements the feature known as unicast reverse path forwarding check to ensuring that packets coming from an I-Light member contain an IP source addresses that is consistent with routing announcements being received from the member. In addition, the I-Light Network implements IP prefix filters, as part of its routing policy, to ensure only pre-approved prefixes are accepted from members.

Through this proposal, I-Light will include in its workshops information concerning the importance of spoof prevention, as well as techniques to effectively prevent spoofing and directed broadcasts at the subnet level.

InCommon implementation

I-Light's parent organization, Indiana University University Information Technology Services, includes experts in the use and deployment of InCommon. I-Light's externally facing network management and provisioning tools, such as AL2S OESS, rely on InCommon and Ship for federated authentication.

As I-Light interacts with researchers at smaller institutions the experience gained through InCommon's use as the default mechanism for access to all IU-delivered research applications created in the past two years will be leveraged by sharing expertise and deployment experience. IU's experience using InCommon for providing access to resources outside of IU includes:

- Indiana CTSI HUB. A translational health research portal for the Indiana Clinical and Translational Sciences Institute, a statewide initiative of IU,

Purdue, and Notre Dame that provides information and services to translational researchers. 1,700 members with 20 institutions federated.

- Alfresco Share. An online service implemented for the Indiana CTSI that supports document sharing, blogs, wikis, discussion groups, task assignment, and calendaring 1,100 users with 20 institutions federated through the Indiana CTSI HUB.
- REDCap. An online data management application for distributed research teams that is designed for clinical research projects. 645 users with 20 institutions federated through the Indiana CTSI HUB
- CTSI Grant Management System. An online application that allows the Indiana CTSI to manage funding opportunities, and manage the grant application process. 1700 members across the state of Indiana through the Indiana CTSI HUB.
- Staff of University Information Technology Services and the Pervasive Technology Institute also support use of the following applications by members of the IU community – all of these applications are accessed via InCommon-based authentication:
- CICme. A collaboration portal of the Committee on Institutional Cooperation.
- EDUCAUSE. A national organization that promotes information technology in higher education.
- Box. A cloud-based file sharing solution provided by Box.net in partnership with Internet2.
- Lynda.com. Online software training.

Sustainability
The activities supported by this proposal, including workshops, perfSONAR deployment, and directory of CI-intensive research, will be incorporated into I-Light's standard operations going forward. It will also be supported via I-Light's budget, within the discretion of its budget advisory committee.