

Often, the best network design is not one based on Layers 2 or 3, but one based on manipulating the physical layer, a flexible optical signal distribution system. This is especially true if one or more of these customer needs are present:

- **Handle a wide and possibly unknown range of optical signal types**
- **Rapidly and remotely**
  - Select from a number of optical signals
  - Change the number of recipients for any input signal
  - Change the recipients for any input signal
- **Maintain a fixed power at the destination receiver independent of the number of recipients**

**Create**

**Monitor**

**Reconfigure**

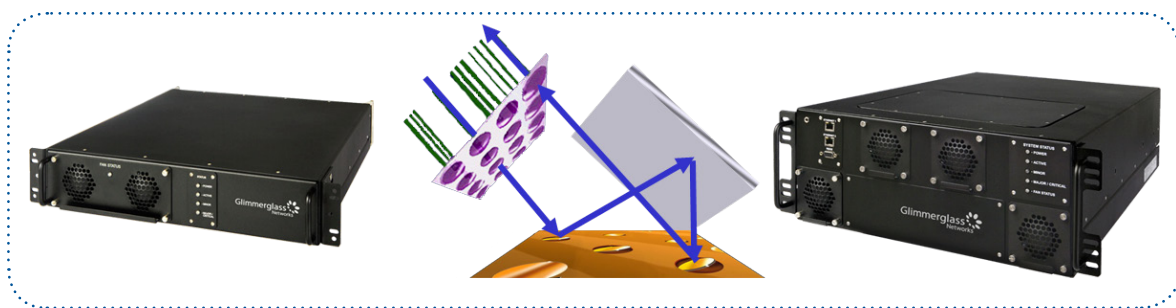
These requirements strongly suggest a photonic solution, a flexible optical signal distribution system. This application note will analyze each of these requirements and give examples showing how these requirements can be met utilizing Glimmerglass Intelligent Optical Systems (IOS) and Intelligent Peripheral Systems (IPS).

### Handle a wide and possibly unknown range of optical signal types

This requirement dictates a true photonic solution. Only a photonic solution has the flexibility to handle any wavelength, data format or data rate without the expensive and time consuming replacement of electrical linecards. With photonic solutions such as the Glimmerglass IOS and IPS, even bundles of DWDM wavelengths can be manipulated as one signal.

### Rapidly and remotely select from a number of optical signals

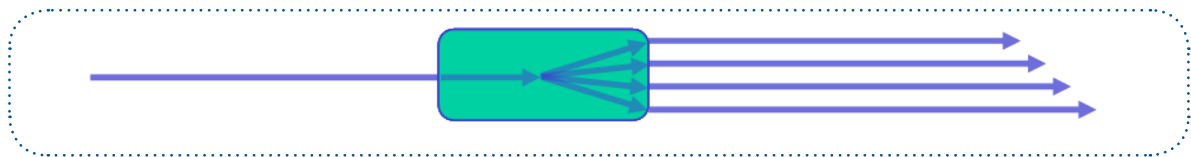
The Glimmerglass Intelligent Optical System is the ideal choice to meet this type of requirement. A full non-blocking, photonic crossconnect, the IOS handles up to 96x96 fibers in 2RU of rack space and up to 192x192 fibers in 4RU of rack space. Highly asymmetric configurations allow the selection from up to 191 fibers in 2RU (191x1). The selection of input fiber(s) can be changed in only 25ms utilizing either the ClickFlow web-based GUI or TL-1 command language.



**Figure 1. Optical Switching**

### Change the number of recipients for an input signal

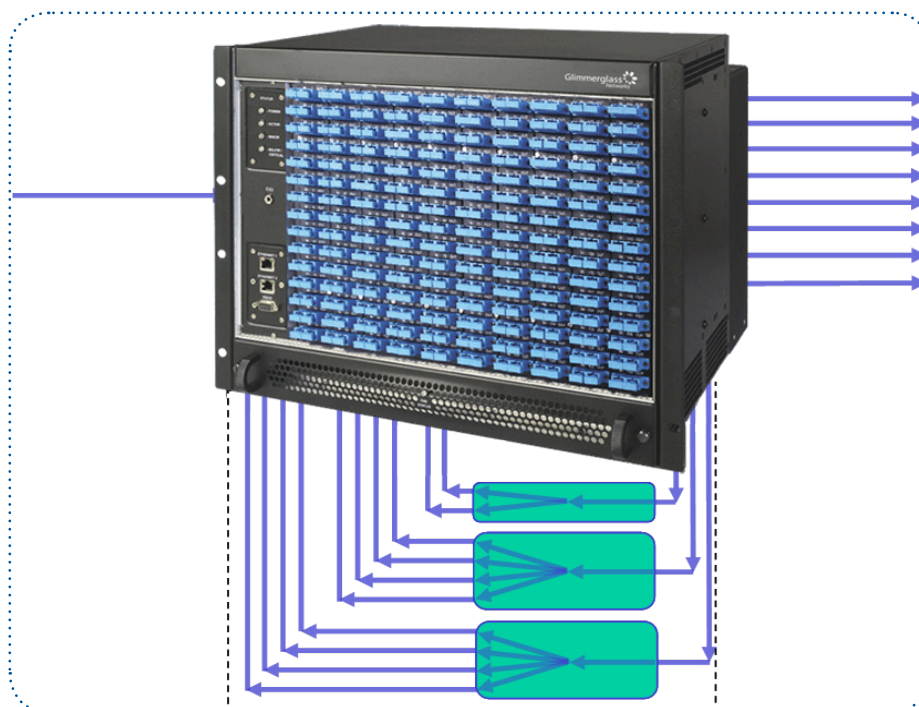
Optical Splitters are the best method of distributing true copies of an optical signal to multiple recipients. A wide range of splitter ratios are available. For example, the Glimmerglass High Density Splitter Module of the Intelligent Peripheral System supports from twelve 1:2 splitters to one 1:16 splitter in a single module, or up to 144 (1:2) splitters in 6RU of rack space.



**Figure 2. Optical Splitting**

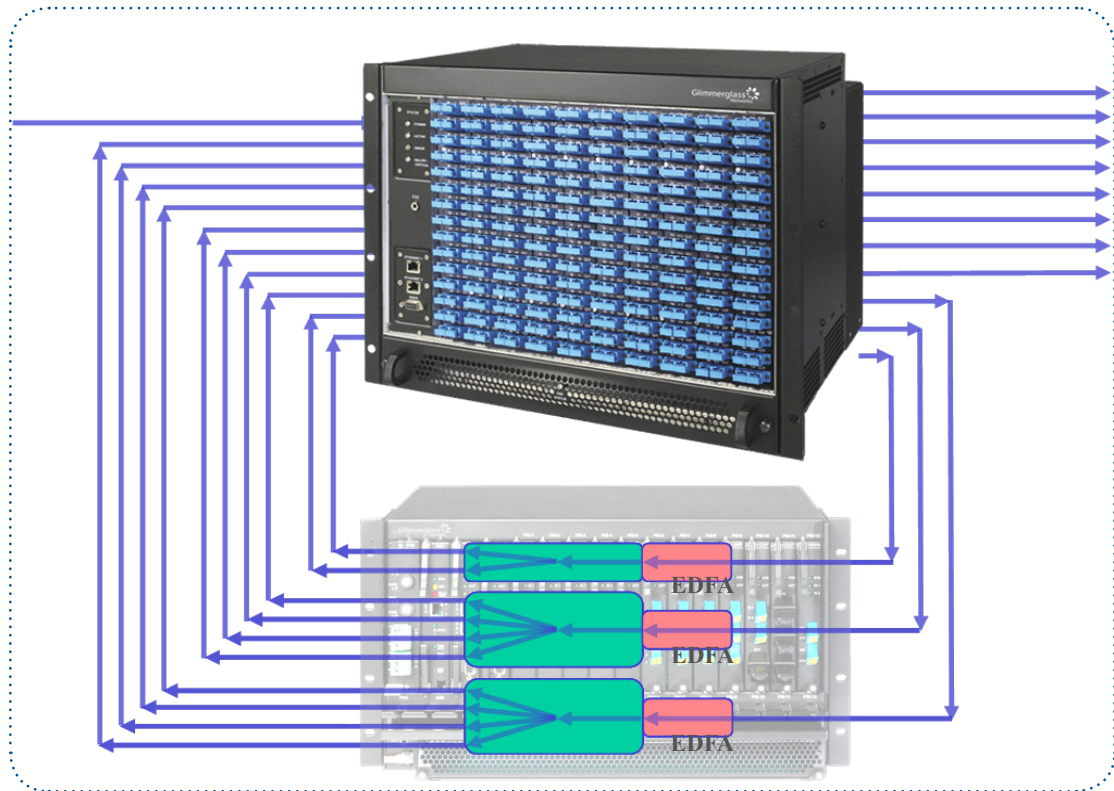
The flexibility of the passive splitter solution is severely limited. First, the inputs and outputs of the splitters are fixed. Second, with high split ratios the optical output power can be unacceptably low.

Glimmerglass has addressed the first problem by combining the power of photonic switching with optical splitters. By offering Photonic Multicast Units (PMUs) as shared resources inside a Glimmerglass IOS, the inputs and outputs of the splitters are under full operator control. If the IOS is equipped with a variety of splitters, the desired splitter ratio can be selected from this shared pool. For applications which require a large number of splitters, the same approach can be implemented with a combination of Glimmerglass IOS and the High Density Splitter Modules of the Intelligent Peripheral System.



**Figure 3. Selective Splitting Using a Glimmerglass Intelligent Optical System**

The second problem, low optical output power, is addressed through optical amplifiers. To minimize amplifier noise contributions, amplification should only be used when required. Thus, instead of amplifying all input signals, and possibly attenuating later, the best solution pairs an optical amplifier with the source of the loss, the splitter. These can be separate units, or integrated, as in the Glimmerglass Lossless Splitter Module of the Intelligent Peripheral System.



**Figure 4. Glimmerglass IPS Lossless Splitter Modules**

The Lossless Splitter Modules can be connected to a single Glimmerglass IOS, or for larger configuration, between two Glimmerglass Intelligent Optical Systems. When the inputs and outputs of Lossless Splitter Modules are connected to a single Glimmerglass IOS, an additional level of flexibility is achieved. By using the IOS to connect the outputs of one Lossless Splitter to the inputs of other Lossless Splitters, larger split ratios can be built up when required without the necessity of preprovisioning large splitters. In this way, unexpected or rare requirements can be addressed rapidly and remotely.

### **Rapidly and remotely change the recipients for any input signal**

As with the selection of input signal, the Glimmerglass Intelligent Optical System is the ideal choice to meet this type of requirement. In this case, symmetric or asymmetric configurations are used to match splitter output with desired recipient.

### Maintain a fixed power at the destination receiver

In an optical distribution system, it is often necessary to handle optical input signals with widely varying optical powers. This could be the result of switching between sources with different optical transmitter characteristics or different splitter ratios. Rapid changes in optical powers can be a problem for some receivers. Thus, the distribution system must be designed to overcome these optical power variations.

Optical power could be adjusted with Variable Optical Attenuators (VOAs), but if the optical distribution system incorporates optical amplifiers to meet some of the requirements above, there is a better and less expensive solution. The optical amplifiers incorporated in the Glimmerglass Dual Optical Amplifier and Lossless Splitter Modules of the Intelligent Peripheral System can be set to operate in either Constant Gain or Constant Output Power mode. In Constant Output Power mode, the Module constantly monitors the input optical power and adjusts the amplifier gain to achieve the desired optical output power. By amplifying only as much as is required and not attenuating, this solution will result in lower overall noise.

### Additional Benefits of Photonic Crossconnects

While an optical signal distribution system can be implemented with passive optical splitters and 1xN and Nx1 switches, there are additional benefits, above and beyond the flexibility shown above, to an implementation with full photonic crossconnects.

Having a full crossconnect facilitates pre-failure monitoring and post-failure problem diagnosis. Once the fault has been identified, loopback paths can be implemented quickly through the crossconnect to help isolate the problem area. In addition, extra ports on the crossconnect can be dedicated to test equipment which can be switched in as needed to monitor traffic and/or to assist in the diagnosis of a failed unit.

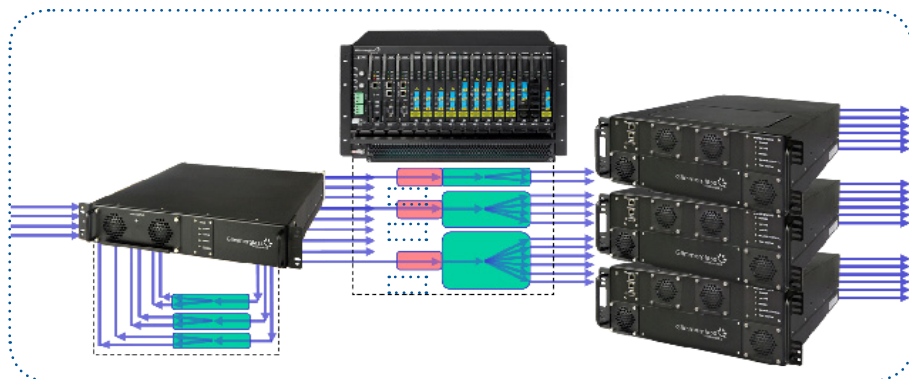


Figure 5. Fully Flexible Distribution Using Glimmerglass IOS and IPS

### Summary

Utilizing the purely optical, photonic switching power of Glimmerglass Intelligent Optical Systems combined with the wide range of optical modules in the Glimmerglass Intelligent Peripheral System a flexible optical distribution system can be designed. This system will be able to handle even the most stringent distribution requirements with the flexibility to rapidly and remotely adapt to sudden and unexpected changes in the operational environment.

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