Dense Wavelength Division Multiplexed Interconnects for High Performance Embedded Computing Architectures

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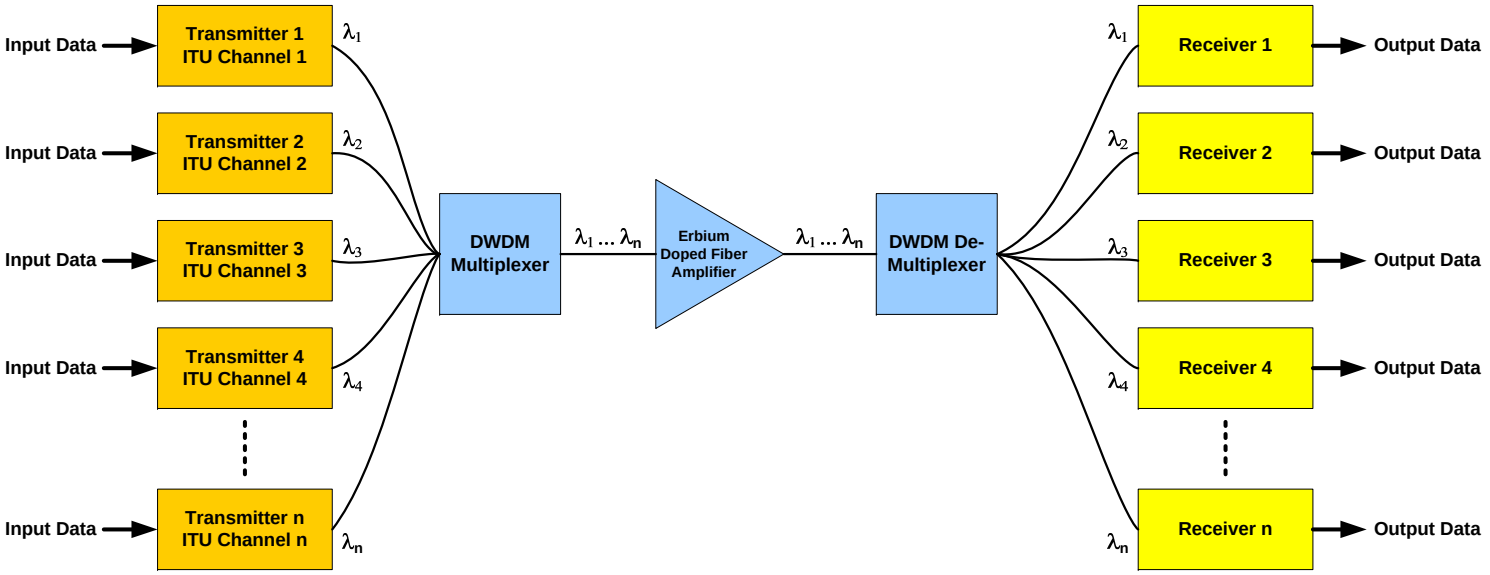
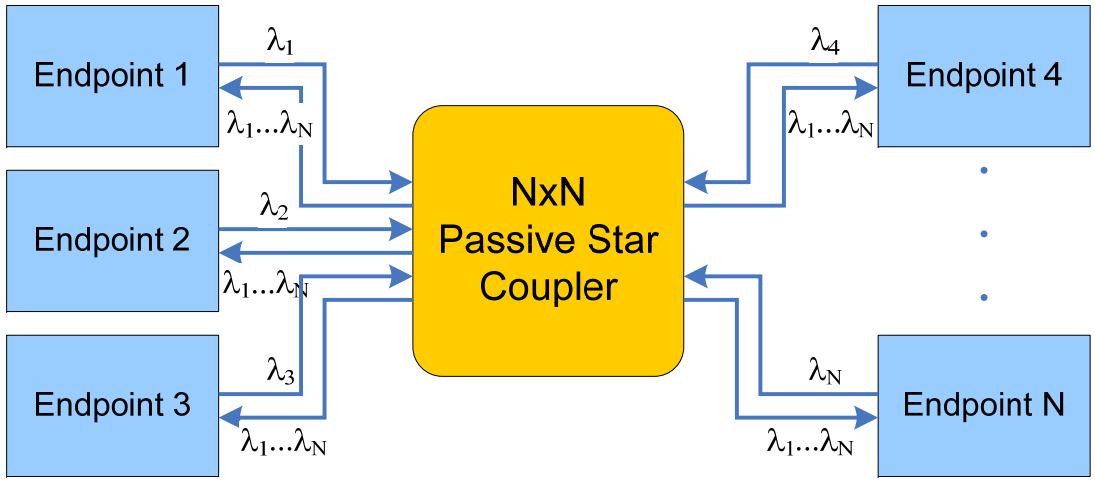
Dense Wavelength Division Multiplexing (DWDM)

- **DWDM fiber optic interconnects form the infrastructure for telco industry's high-bandwidth backbones**
- **Numerous advantages over electrical interconnects**
  - ***Extremely high data capacity (100's of Gbps to 10's of Tbps per fiber).***
  - ***Improved signal integrity leading to increased link distances.***
  - ***EMI immunity.***
  - ***The ability to increase data rates and add communications channels without changing the cabling infrastructure.***
  - ***Lower-weight cabling.***
- **To date, environmental and packaging concerns have limited the applicability in HPEC systems**



Passive DWDM Networks

- **Wavelengths are centered around C-Band (1550 nm) or L-Band (1595 nm)**
  - ***Spaced at 50, 100, or 200 GHz increments***
  - ***Conforms to ITU grid***
- **Passive combiners and splitters permit full connectivity between endpoints**
  - ***Active components isolated to Tx/Rx endpoints***
- **Creates a passive, optical broadcast interconnect that is protocol and data-rate agnostic**



Application of Passive DWDM Interconnects to HPEC Systems

- **Additional endpoints can be added to system with no impact on previously installed hardware**
  - ***Enables low-cost technology insertions***
- **Can carry multiple protocols on a single fiber at multiple signaling rates**
  - ***10G Ethernet, 1G Ethernet, SRIO, Fibre Channel, Infiniband, custom, etc.***
  - ***Allows I/O-challenged systems to push beyond their current limitations***
- **Eliminates contention and blocking in the network**
  - ***All endpoints are assigned a unique wavelength for transmission***
- **Allows new levels of sensor data sharing**
  - ***Data is inherently broadcast to all endpoints with no additional overhead***
- **Eliminates the need for switching hardware, reduces SWaP**

Challenges of Passive DWDM Interconnects in HPEC Systems

- **Reduction of the SWaP envelope of the DWDM transmit and receive endpoints so that they can be designed into standard HPEC form factors such as PMC, XMC, and VPX.**
- **Hardening the active components against the temperature, shock, vibration, and other environmental requirements encountered in HPEC systems.**
- **Addressing Information Assurance (IA) and Multi-Level Security (MLS) requirements by developing a secure passive infrastructure for systems where data separation must be provided.**
- **Developing endpoint firmware that leverages standard high-speed point-to-point protocols, such as Serial RapidIO or 10 Gigabit Ethernet, while updating them to support the DWDM broadcast interconnect.**

Lockheed Martin MS2 is actively addressing each of these challenges

Thank-you!