



# Flexible OTN (FlexO)

## OFC 2024

*Update on the series of FlexO Recommendations  
approved in March 2024*

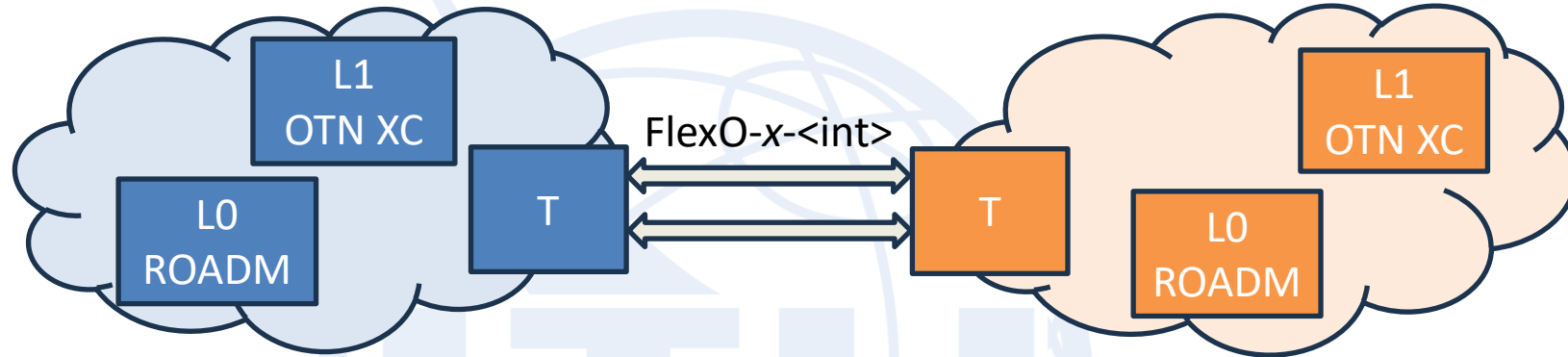


# Flexible OTN (FlexO) - overview

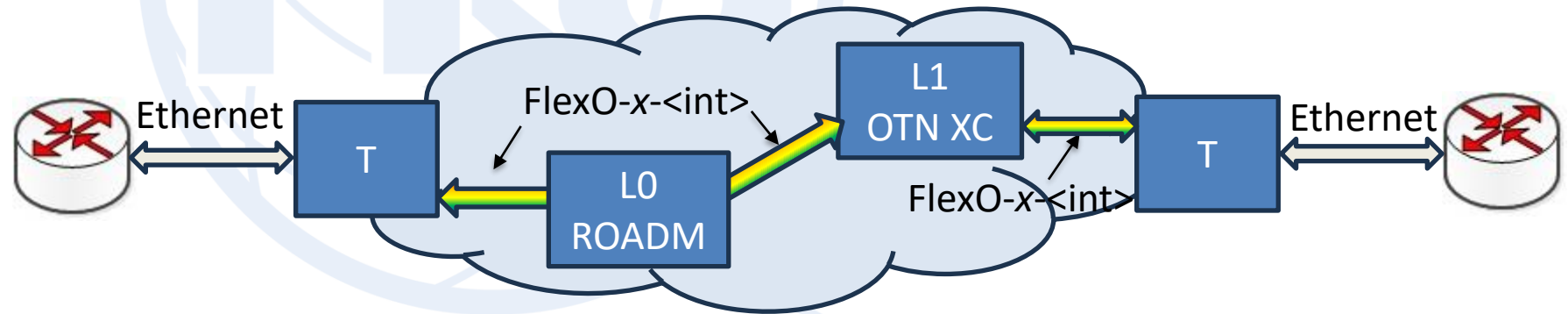
- Initial version approved in 2017 defined
  - The frame format and interface for short-reach point-to-point applications that used inverse multiplexing (bonding) to carry beyond-100G (B100G) OTN signals over multiple 100G modules
- Current series, approved in March 2024, provides support for
  - Short-reach applications
  - Metro long-reach applications
  - Modules using bit rates of 100G, 200G, 400G, and 800G
  - Inverse multiplexing (bonding)
  - Regenerators to support multi-span applications
  - Frame formats and interface rates optimized for Ethernet

# FlexO – Application examples

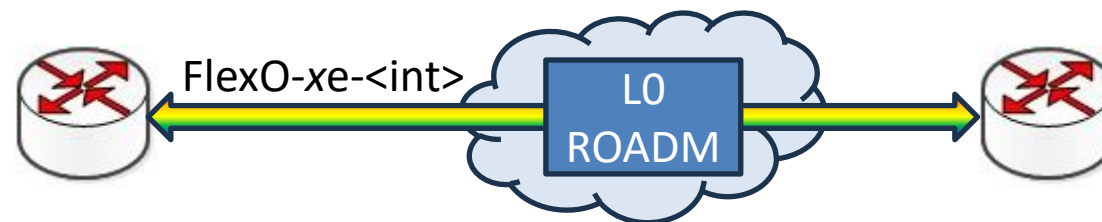
Short-reach handoff between transport networks



Long-reach connectivity within a metro transport network (e.g., for router interconnect)



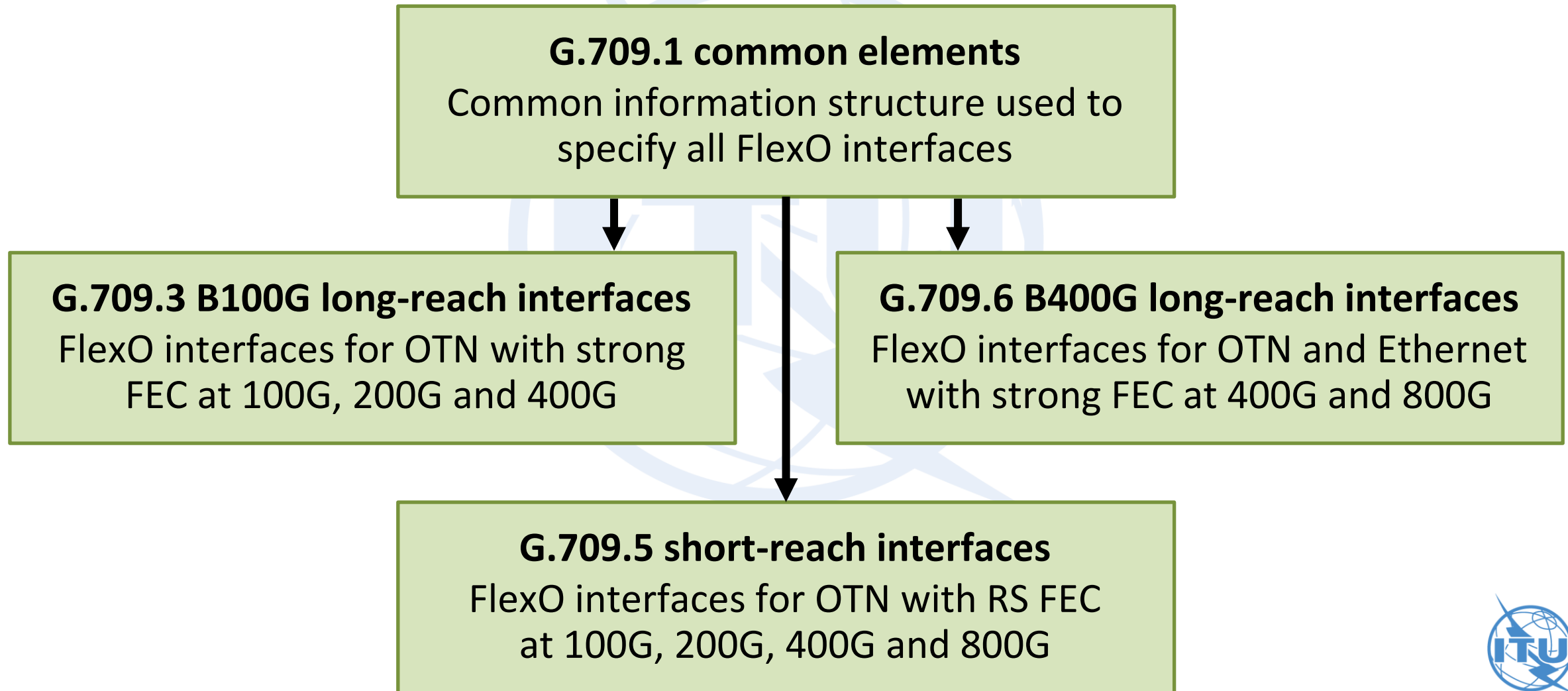
Direct router interconnect using Ethernet-optimized FlexO-xe



# FlexO Recommendations

- Used as the basis for interface specifications in the OIF, OpenZR+ MSA, and the OpenROADM MSA that address different applications
- To facilitate reuse, the latest release of the G.709.x series of FlexO Recommendations was restructured to make it easier for other SDOs or MSAs to reference the parts of the specifications that are relevant to their target application

# Structure of the FlexO Recommendations



# FlexO common elements (G.709.1)

- Frame format, alignment mechanism, interleaving and bonding
- Overhead for OAM functions
  - Management of interface group bonding, in-band communication channels, timing transfer and status
  - Optional fields to support regenerators
- Map and multiplex one or more clients into a FlexO group
  - OTN (OTUCn) into a FlexO-*n*
  - Ethernet into an Ethernet optimized FlexO-*ne*
- Optional FlexO encryption and authentication scheme

# FlexO long-reach interfaces

- The common elements defined in G.709.1 are used to define a set of multi-vendor interoperable long-reach interfaces
- G.709.3 defines interfaces (including strong FEC) for 100G, 200G and 400G metro long-reach applications
- G.709.6 defines interfaces (including strong FEC) for 400G and 800G metro long-reach applications
  - Supports Ethernet optimized FlexO interfaces with lower data rates enabled by direct mapping of Ethernet clients up to 800GE

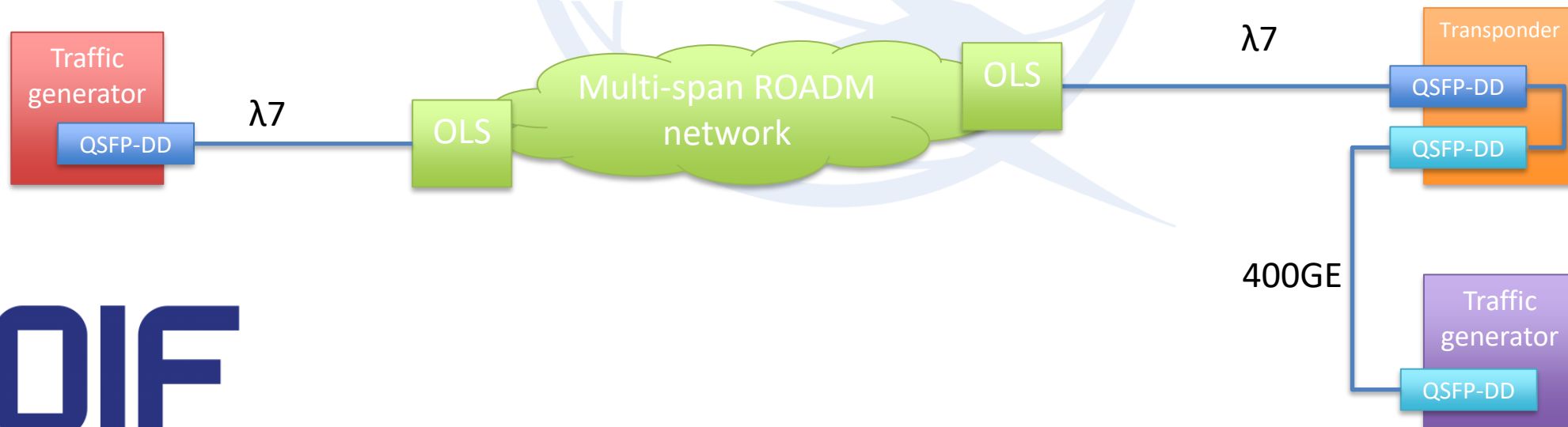
# FlexO short-reach interfaces

- G.709.5 uses the common elements from G.709.1 to define a set of multi-vendor interoperable short-reach interfaces carrying OTN (OTUCn) signals at rates of 100G, 200G, 400G and 800G.
- These interfaces use Ethernet optical modules with OTN rate support and the Ethernet RS FEC to provide a reach of up to 40km



# FlexO interoperability demonstration

- Multivendor interoperation of FlexO-4-DO interfaces is being demonstrated in the OIF booth (#1323)
  - Diagram is a subset of the entire test network
  - Colours indicate different system and module vendors



# Additional FlexO information

- Flyers describing the FlexO Recommendations are available from



