



THE ELASTIC NETWORK



# DRIVING STANDARDS FROM CODE – ECI'S WORK WITH ONOS

Hayim Porat, CTO  
Sarit Tager, VP R&D SDN

# WHERE IS THE INDUSTRY TODAY?

Vendor lock-in

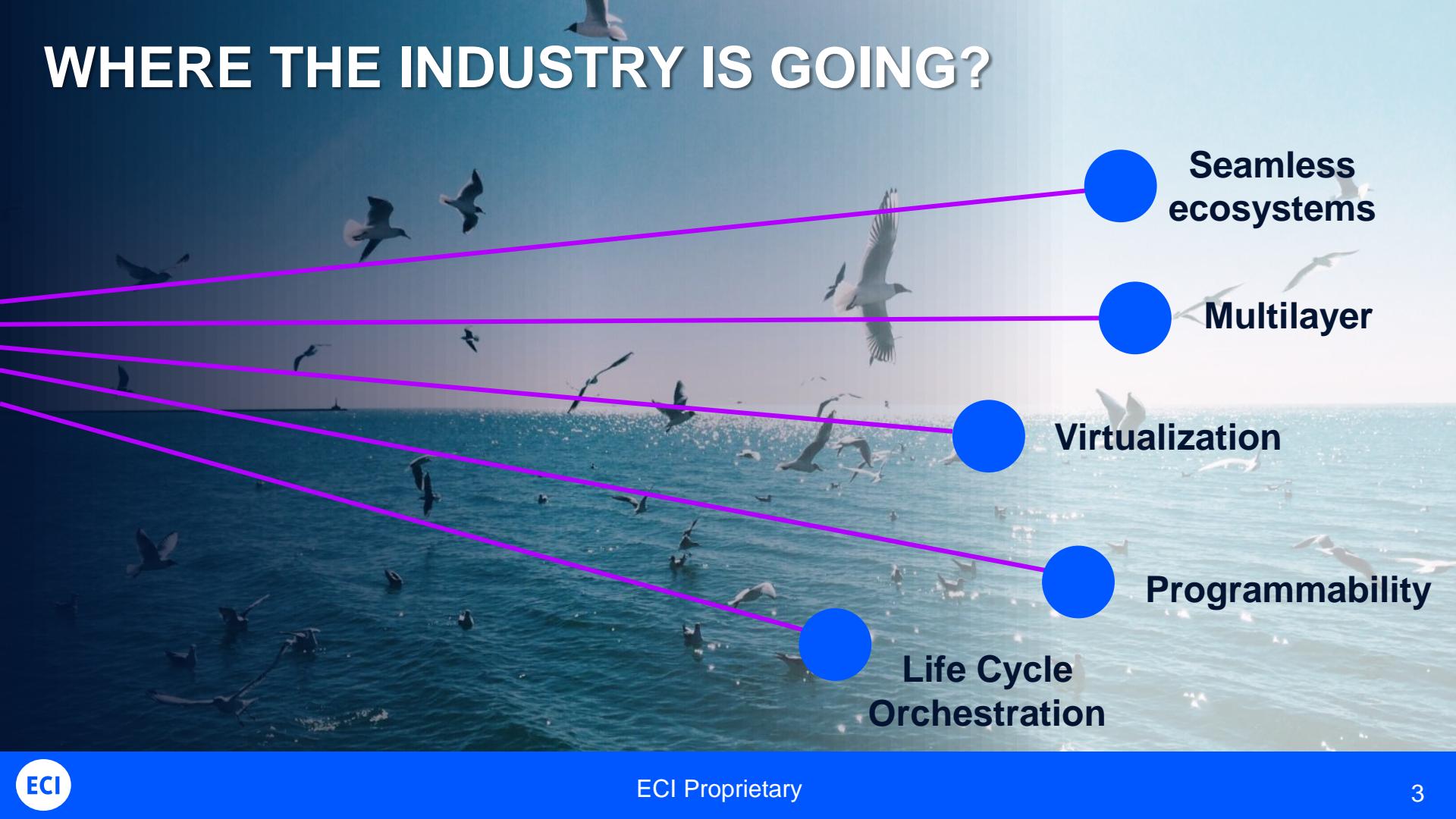
High cost of introducing/exchanging vendor

Limited interoperability/rigid architecture

Closed management system

Traditional working processes

# WHERE THE INDUSTRY IS GOING?

A photograph of a large flock of seagulls flying over a body of water under a clear blue sky.

Seamless ecosystems

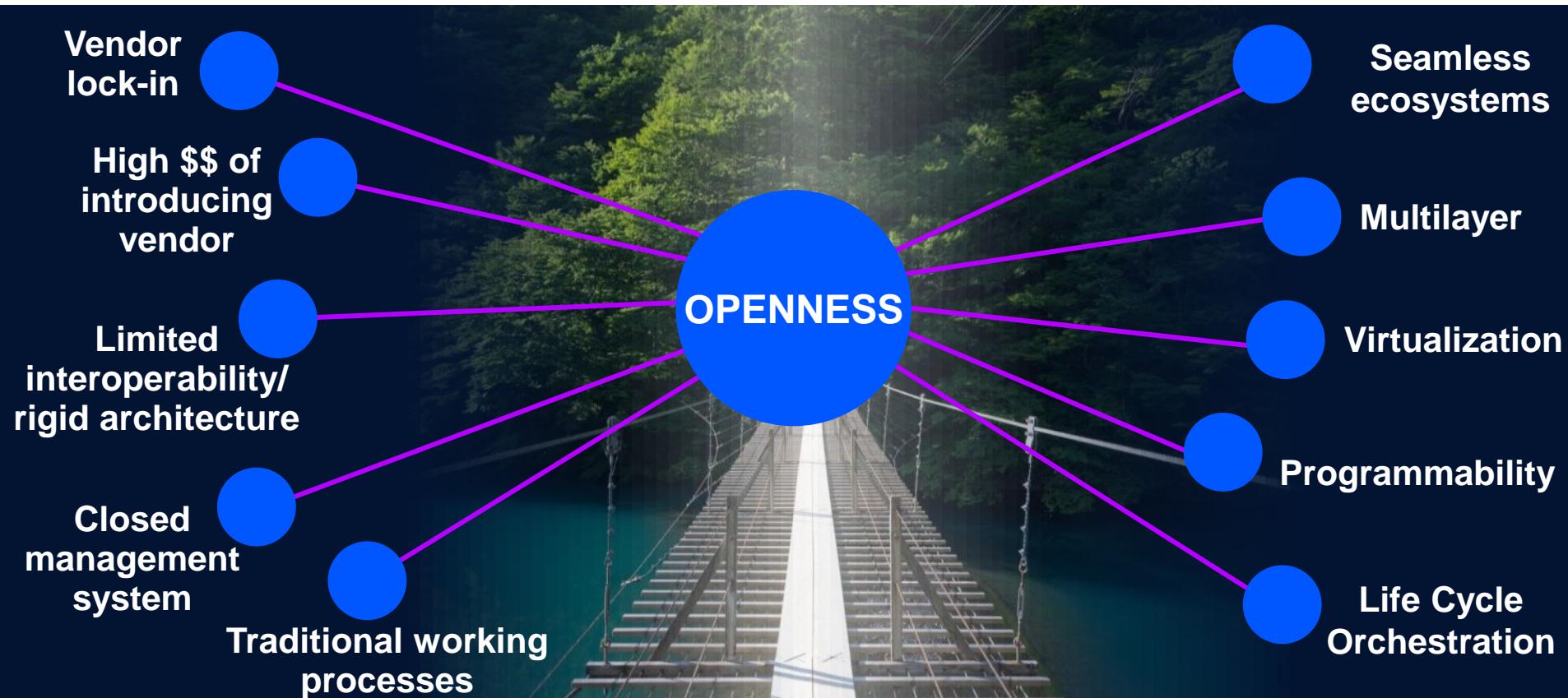
Multilayer

Virtualization

Programmability

Life Cycle  
Orchestration

# ECI EFFECTIVELY BRIDGING THE GAP



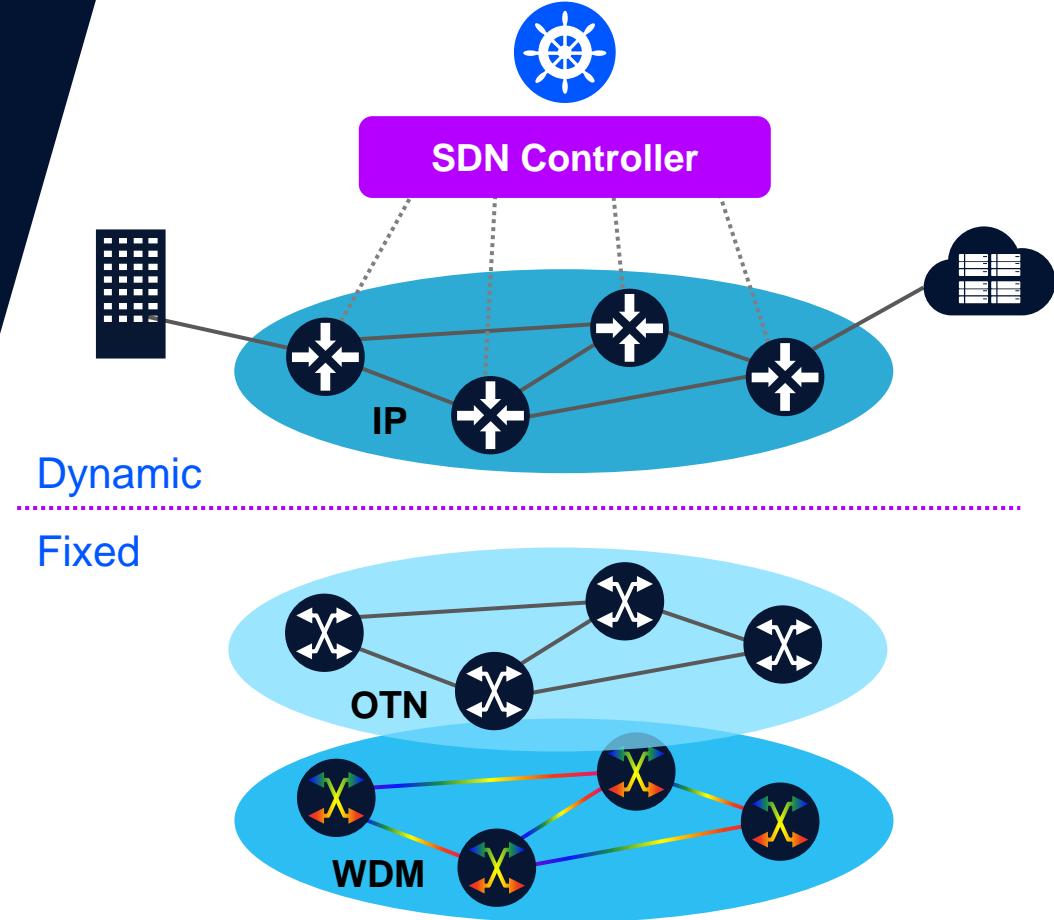
# OPEN TELECOMMUNICATIONS STANDARDS

Foster growth of telecommunications markets by enabling **ecosystems** where diverse participants can interoperate with each other to create a whole that is greater than the sum of the parts



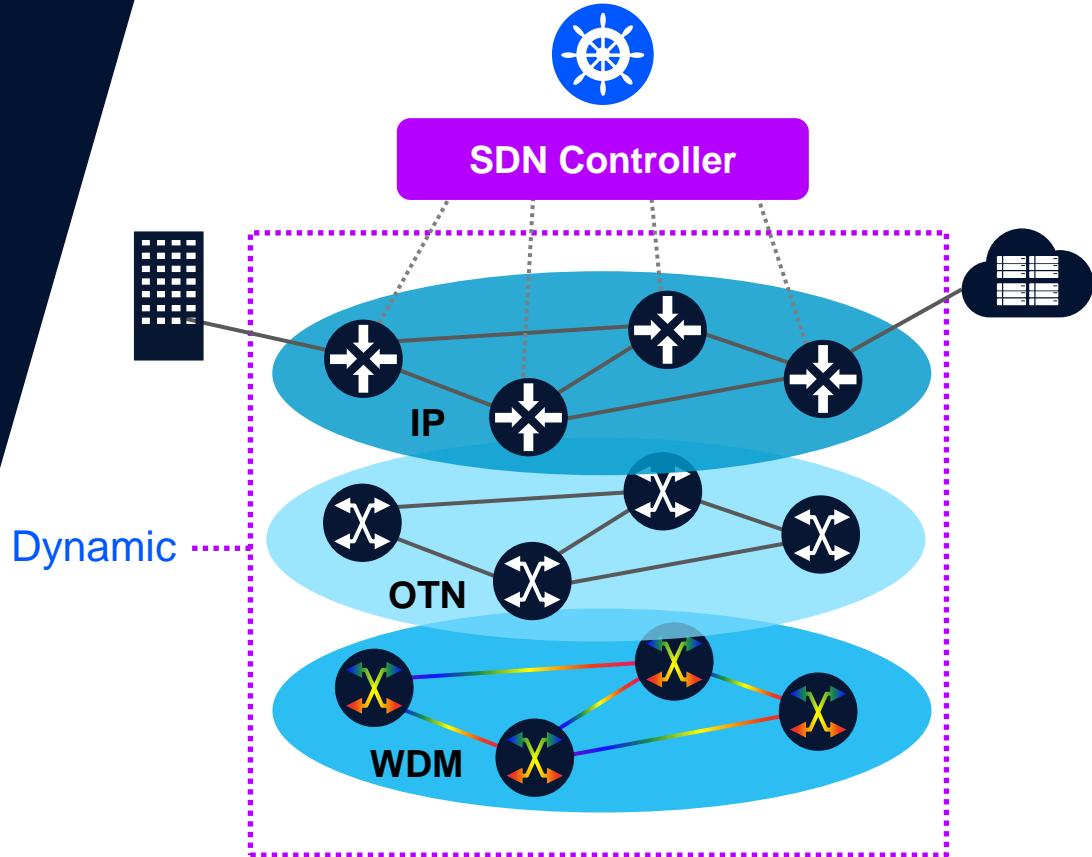
# WAN SDN TODAY

- Separation of control plane and forwarding plane at IP layer
- Regard underlying OTN and WDM layers as fixed underlying pipes



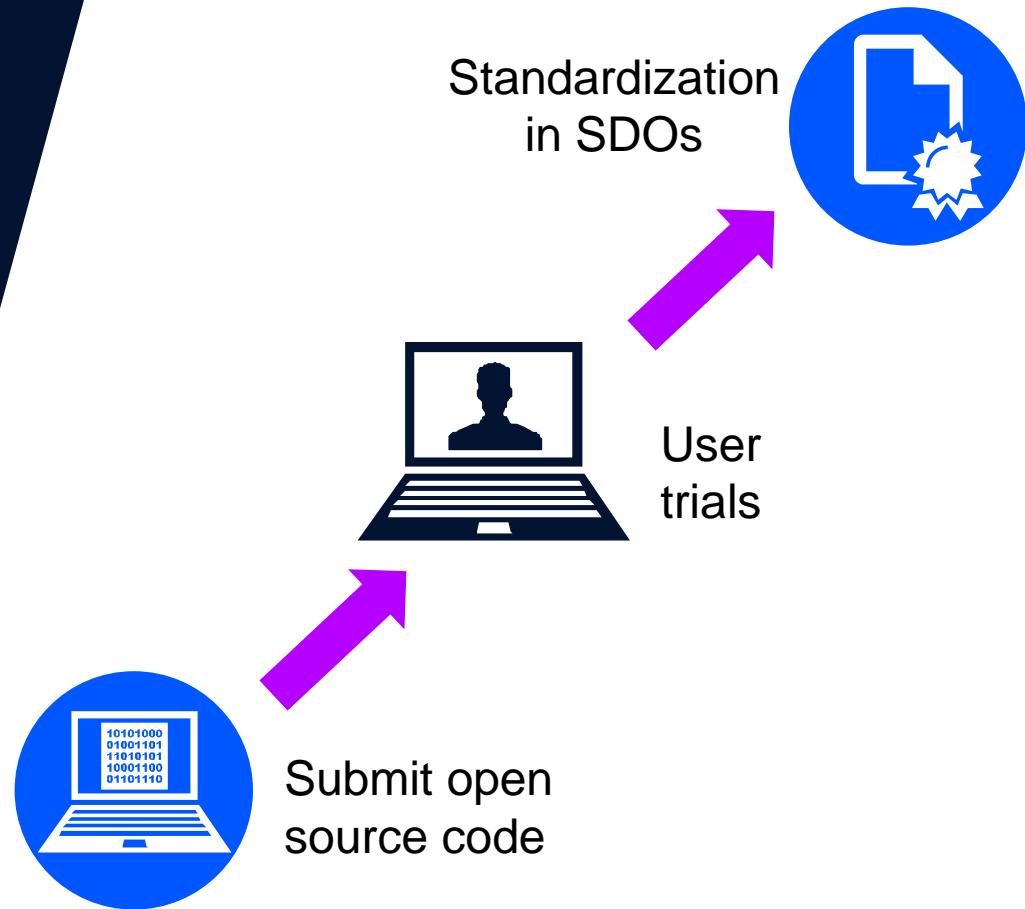
# MULTILAYER WAN SDN

- SDN can make these layers interactive and dynamic
- Can exploit untapped OTN and WDM flexibility



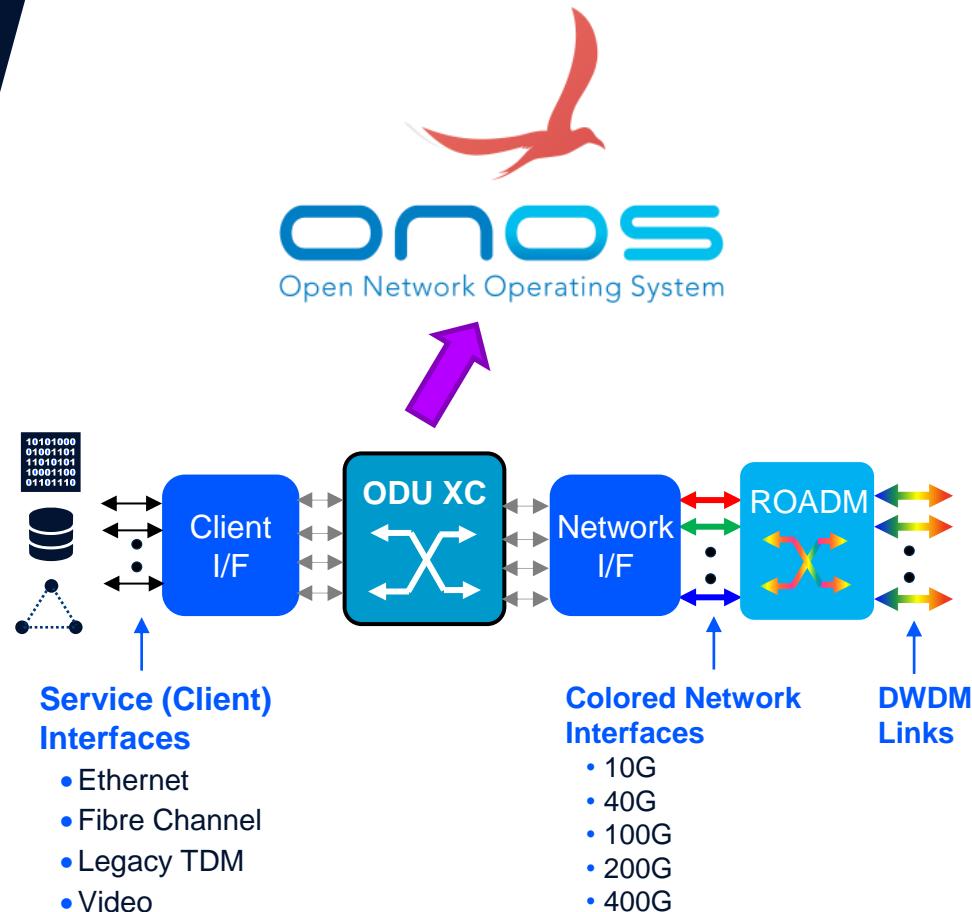
# ECI APPROACH

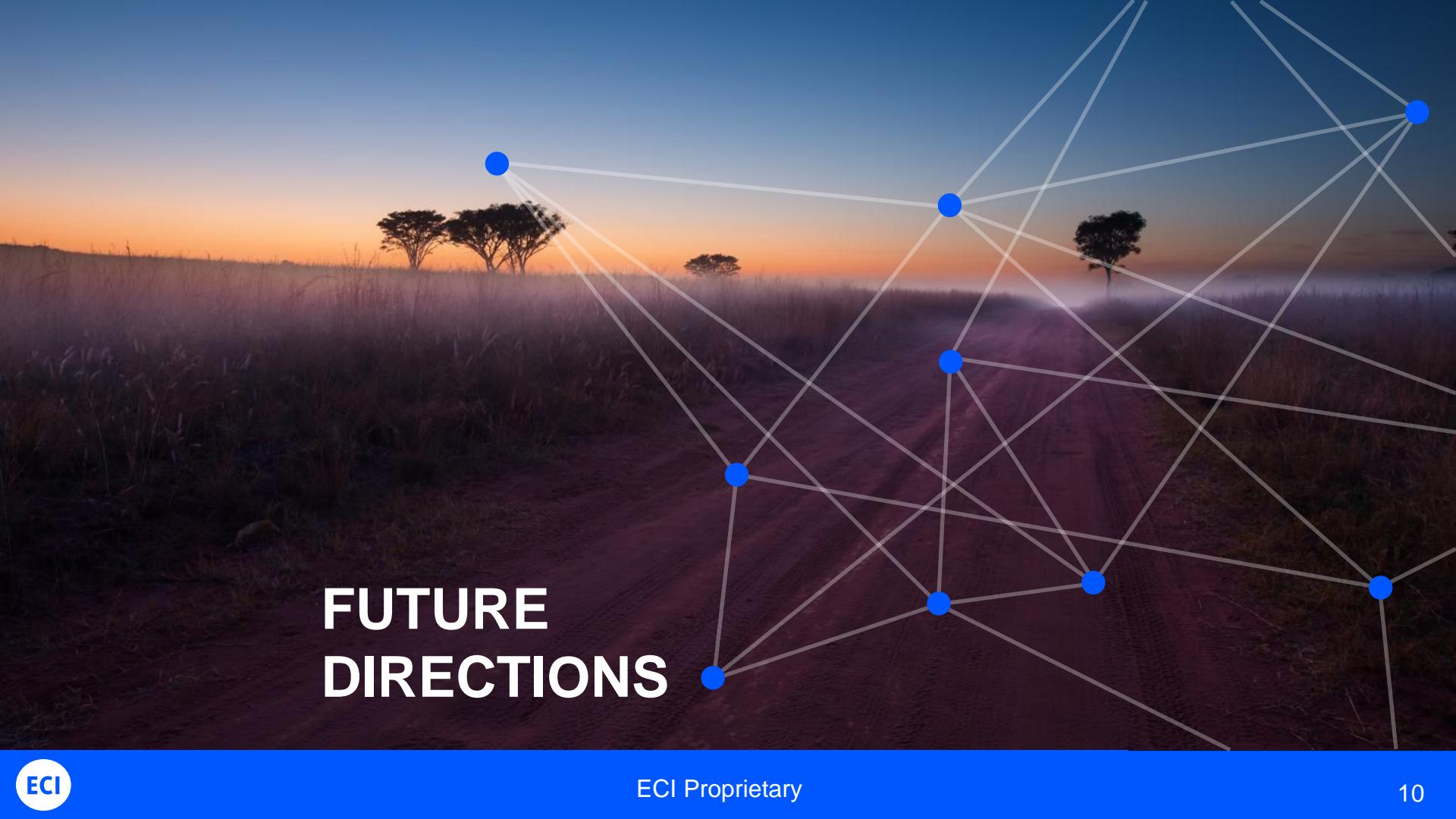
- Code is king
- Let users play and refine
- Successful use drives standardization



# OUR STARTING POINTS

- ONOS SDN Controller
  - WAN oriented
  - Carrier grade
  - Truly programmable networks
- Address gap at ODU layer

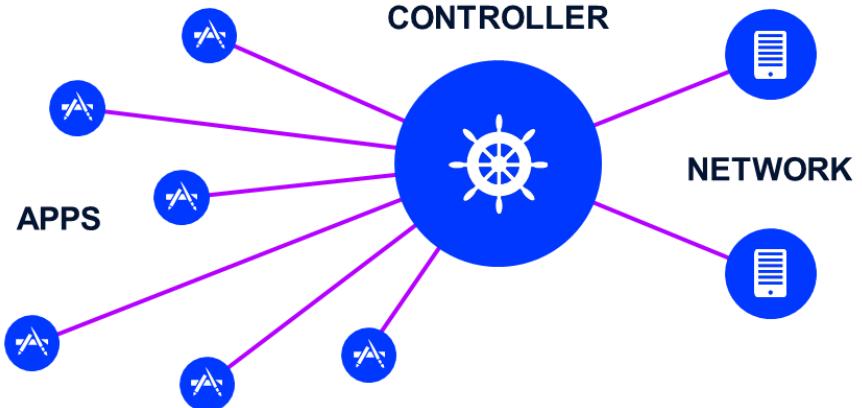




The background image shows a savanna landscape at sunset or sunrise. In the foreground, there's tall grass. In the middle ground, there are several acacia trees. The sky is a gradient from blue to orange. Overlaid on the image is a network of blue dots connected by white lines, forming a complex web that spans across the frame.

# FUTURE DIRECTIONS

# CARRIER GRADE CONTROLLER



- Multi instance for scale and resiliency – improve on current designs
- Distributed infrastructure for SDN applications
- Agile large scale reactive controller

A photograph of a sunset over a calm ocean. In the foreground, a dark beach chair sits facing the water. A network graph is overlaid on the image, with several blue circular nodes connected by white lines. One node is located on the beach chair, another is near the horizon, and others are scattered across the sky.

# How Did We Do It?

Warning – Real Deep Dive ☺

# OPTICAL USE CASE – ODU MULTIPLEXING

## Why

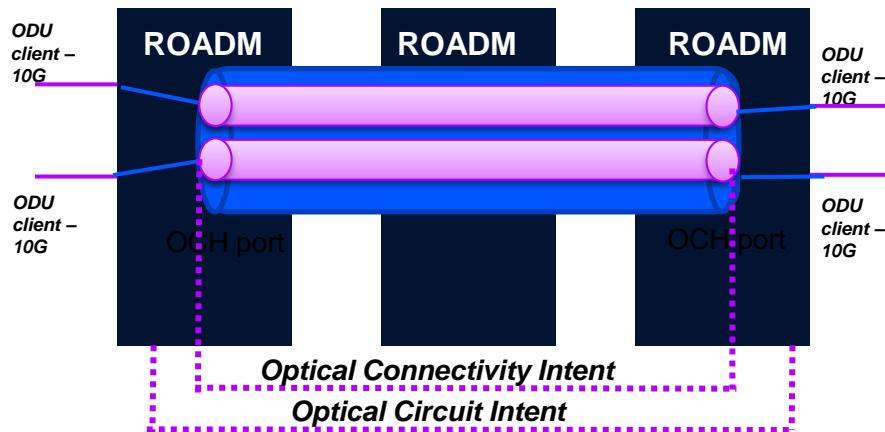
- Add multiplexing points for optical layers (similar to VLANs but ODU clients to OCH )
- Enable flexibility in mapping multiple ports to same optical channel
- Utilize each OCH port to contain several services

## What

- Add Multiplexing of several OduCLT to single OCH trail (Lambda)

## How

- The work was done based on ONOS Optical Intents (mapping client port to OCH port)
- Optical Circuit Intent – Modified to include ODU Tributary Slots
- Supported through Optical Connectivity Intent
- Tested with ECI Optical Equipment (supporting OpenFlow 1.3)



# OPTICAL USE CASE – ODU CROSS CONNECT

## Why

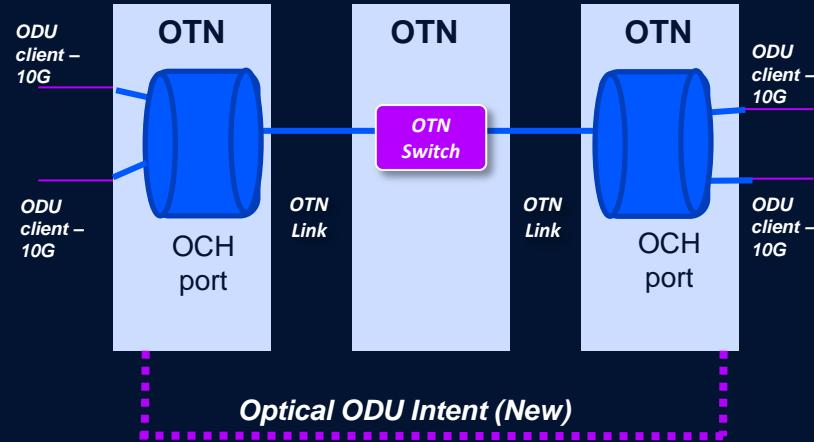
- ODU cross connect enhance the flexibility of forwarding | within optical network (the cross connect can be done in ODU level rather than OCH level)

## What

- The option to perform ODU cross connect didn't exist in ONOS, hence prevented from creating connections via ODU switches
- Create ODU trail over topology based on OTN Devices

## How

- Introduced
  - *New Intent – Optical ODU intent*
  - *New Port – OTU Port*
- Tested with ECI Optical Equipment (supporting OpenFlow 1.3)



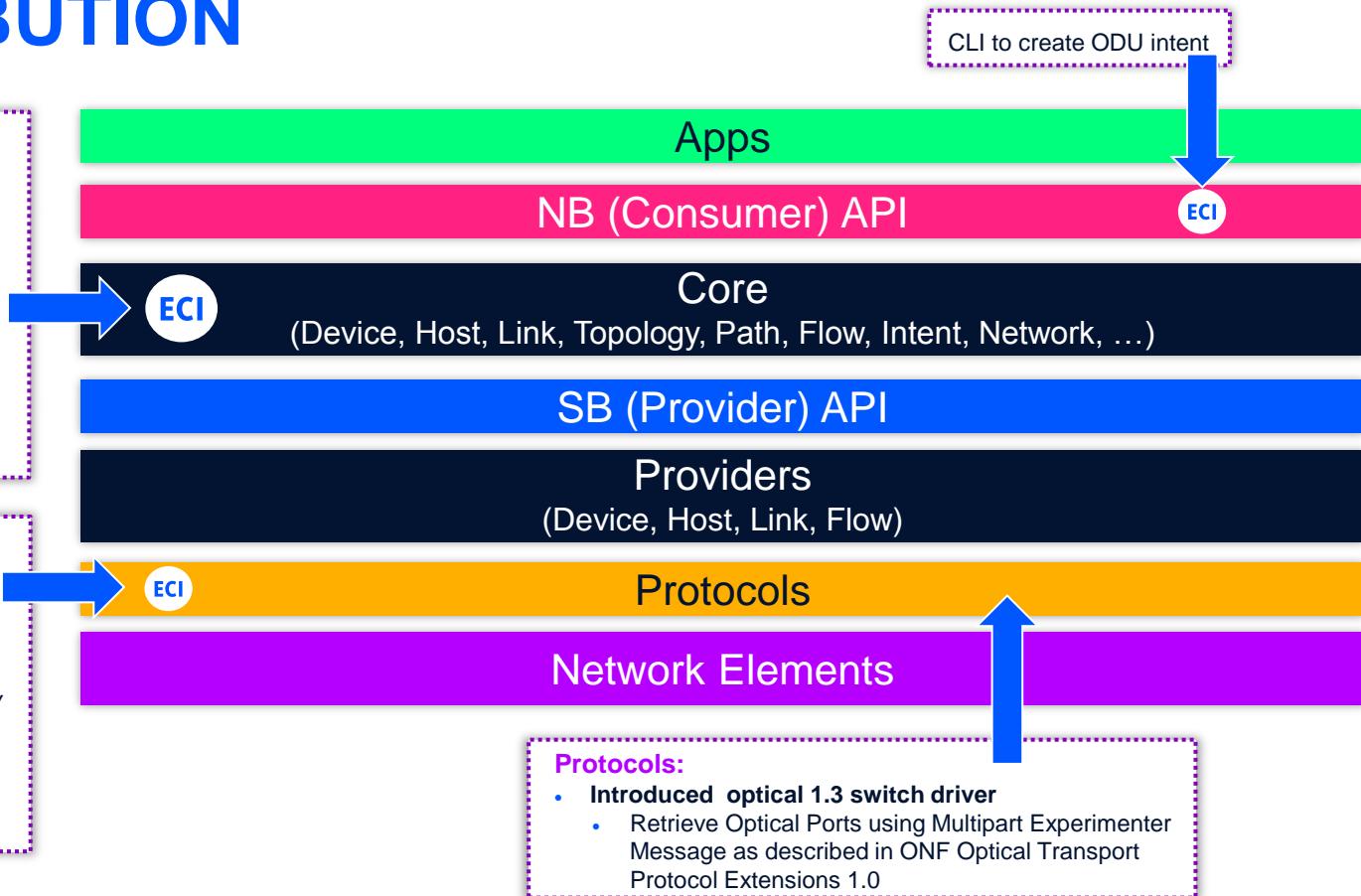
# ECI CONTRIBUTION

## Core changes :

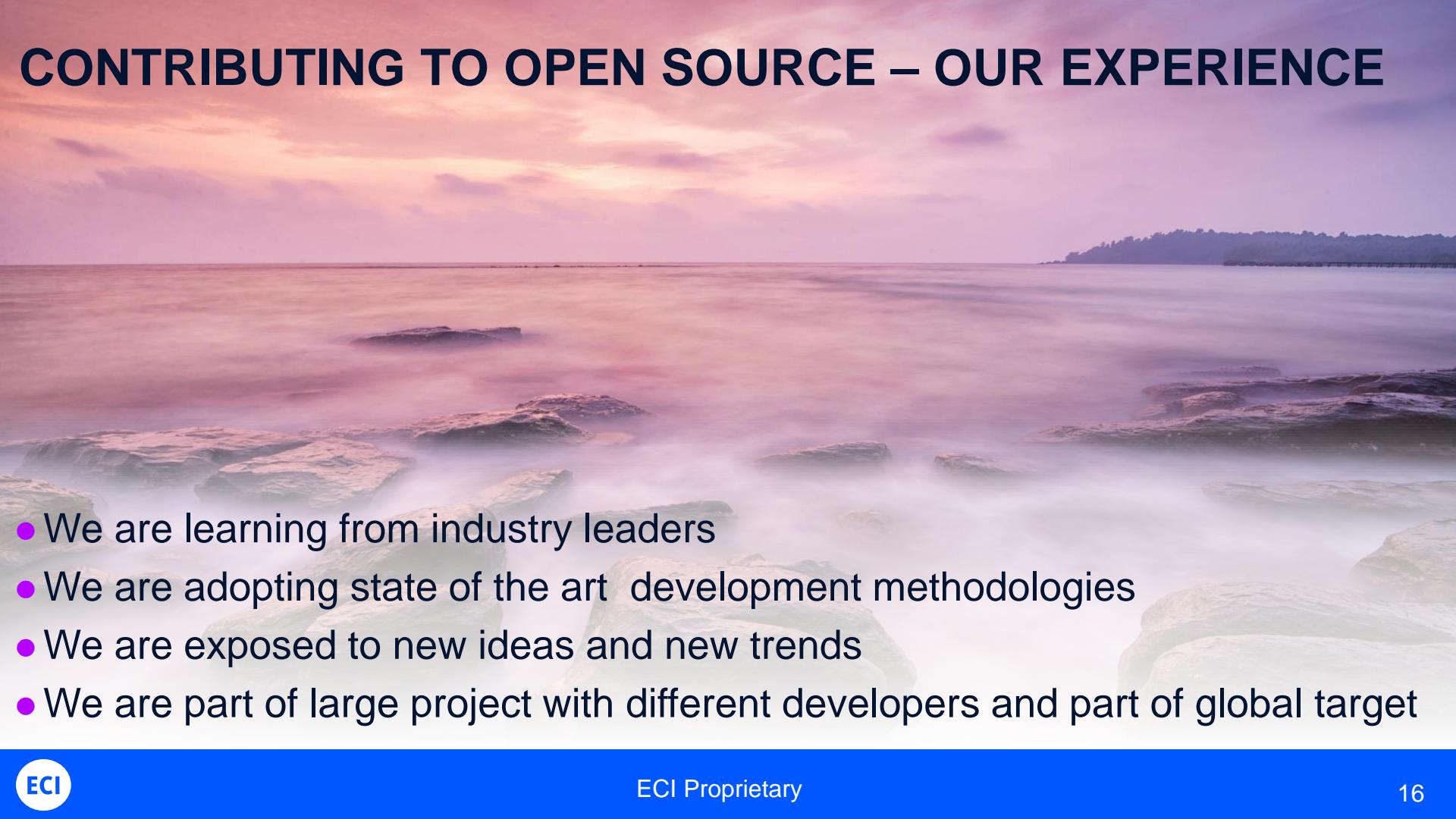
- ONOS Core Information Model
  - Add support for OTU port
- ONOS Intent
  - Enhance Optical Circuit Intent to support ODU Multiplexing
- New Optical ODU Intent
  - Add Resource Management for ODU Tributary slots
  - Several ODU tributary slots on same OCH port
  - Several ODU tributary slots on same OTU port

## Protocols:

- Enhance Open Flow 1.3 (ONOS Loxi Project) - Add support for OF Optical Extensions based on ONF Optical Transport Protocol Extensions 1.0
  - Add Flow Match and Actions: OXM TLV (*ODU\_SIGTYPE*, *ODU\_SIGID*, *OCH\_SIGTYPE*, *OCH\_SIGID*)
  - Port Description using Multipart Experimenter Message



# CONTRIBUTING TO OPEN SOURCE – OUR EXPERIENCE



- We are learning from industry leaders
- We are adopting state of the art development methodologies
- We are exposed to new ideas and new trends
- We are part of large project with different developers and part of global target

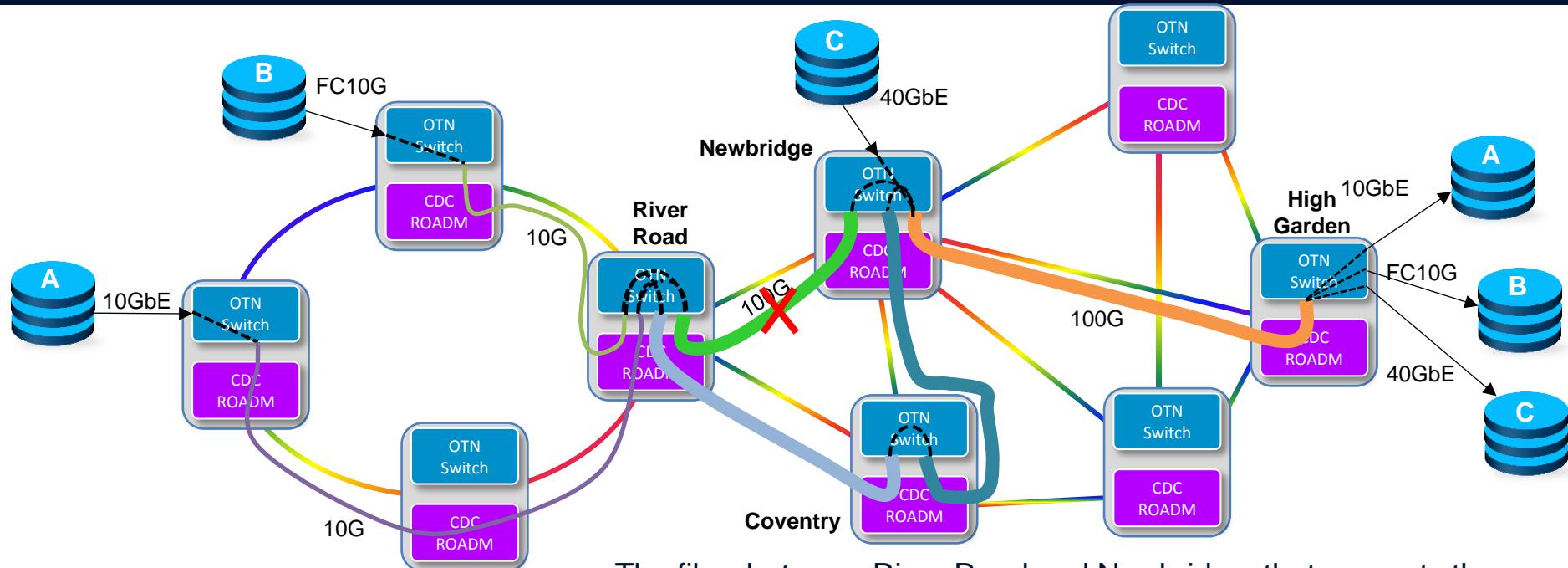


“  
ORGANIZATIONS THAT WILL BE ADAPTIVE  
ARE THE ONES INVENTING THE FUTURE.  
– *The Elastic Enterprise*



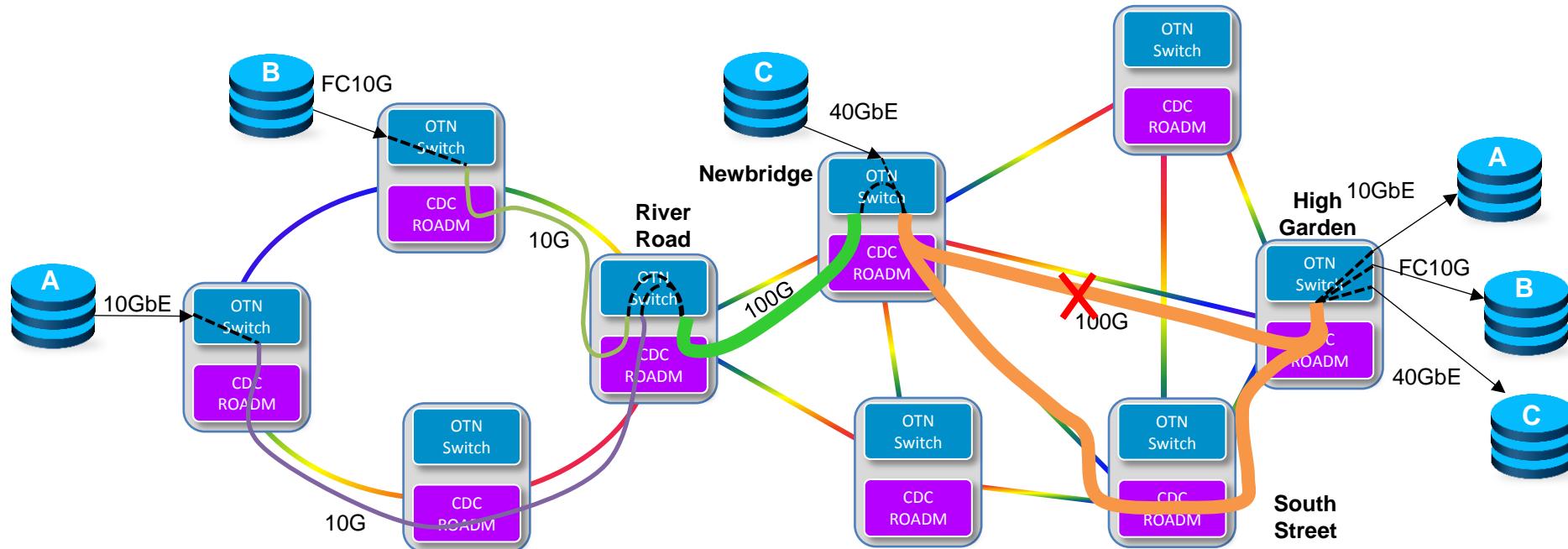
THANK YOU!

# OTN RESTORATION APPLICATION



- The fiber between River Road and Newbridge, that supports the 100G channel carrying the 'A' and 'B' 10G service streams, is cut
- The SDN control plane, **uses OTN switching** to re-route these 10G service streams through the Coventry node

# ROADM RESTORATION APPLICATION



- The fiber between Newbridge and High Garden, that supports the 100G channel carrying all three 'A', 'B', and 'C' service streams, is cut
- The SDN control plane re-routes the entire 100G purple wavelength, ***and all the services it carries***, through the South Street ROADM without any further OTN switching

## **Abstract**

ECI Telecom had traditionally developed proprietary code based on telecom industry standards. With SDN (and NFV) ECI made a strategic decision to move to open source. The first platform was chosen to be the SDN controller. After testing and evaluating several options ECI decided to go with ONOS. Moreover, ECI had decided to take the approach of "code is king" by promoting innovation into industry standards (in this case Openflow) first contributing code to the community, let the community asses its value and only then, try to take it to the SDOs. In this presentation we will present the process ECI went through in adopting open-source and will discuss the work we have done in augmenting OF with optical capabilities as well as our suggestions for a much more agile packet based OF and its impact on the controller architecture.

## **Audience**

Anyone interested in developing SDN software in open source and especially in advanced IP operations in a SDN framework

## **Experience Level**

Intermediate

## **Benefits to the Ecosystem**

For the open source community it will be beneficial to show how the transition to open source can leverage legacy companies. For the OF community it will demonstrate the innovations that can be delivered in the SDN framework

## **Technical Requirements**

Good knowledge of OF and its data model