



# Certified Optical Network Engineer

*A unique training course from Optical Technology Training, delivered by licensed partners around the world*



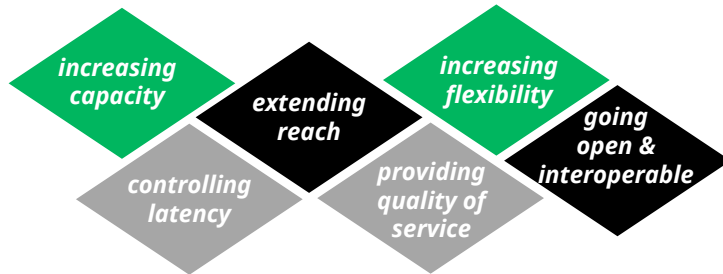
# Certified Optical Network Engineer (CONE)

5 days



Design course

The growth of the Internet, cloud services, 5G networks and AI are all putting immense pressure on the optical networks that support them. On this course you will learn how optical networking technology can meet the key challenges shown below:



All of this whilst keeping costs under control and reducing electrical power consumption so that the Internet doesn't cost the Earth.

You will appreciate how the powerful combination of coherent transmission & digital signal processing has transformed optical communications at data rates of 100Gb/s, 400Gb/s, 800Gb/s and beyond, comparing *coherent lite* for shorter distances with long haul coherent solutions.. You will learn about the changes necessary to DWDM systems for operating efficiently at data rates of 400Gb/s, 800Gb/s & above.

Understanding how the right mix of optical and electronic technologies is used to overcome limitations is a recurring theme of the course, as is the role of SDN and its implications for facilitating open systems including open optical line systems, coherent pluggable transceivers, disaggregation, Open ROADMs & white box solutions.

You'll appreciate the fundamental limitations that apply & the trade-offs & compromises to be made, so that you can make strategic decisions & long-term plans for your network.

## Key outcomes

- ✓ design your system to avoid unwanted non-linear effects
- ✓ identify the best type of fibre for new projects
- ✓ decide which pluggable form factors are best for your applications
- ✓ plan for efficient deployment of OIF 400ZR for DCI
- ✓ assess the role of coherent lite for shorter distances & compare it with long haul coherent solutions
- ✓ appreciate the trade-offs made by adaptive optical transceivers
- ✓ identify options for delivering 10Tb/s over distances from 100m to trans-oceanic
- ✓ decide on optimum amplification schemes for your network links
- ✓ assess the role of subsea SDM ideologies for terrestrial networks
- ✓ assess the role of flexgrid and plan for its implementation
- ✓ specify appropriate ROADM functionalities for current operations and future developments
- ✓ plan your networks to avoid unnecessary latency
- ✓ decide upon appropriate FEC schemes and DSP technologies
- ✓ assess what role SDN and open networking will have in your network & make plans
- ✓ understand the implications of deploying white box solutions
- ✓ use a methodical process to set valid design strategies and policies, to guide your network design decisions

This is an advanced level course. If you will be attending a public CONE course it is a requirement that you attend the **CONA** Certified Optical Network Associate course first. *Find more info [online](#).*





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## BECOMING A CONE

- ❑ 6th & 7th generations of optical networks
- ❑ The week ahead

## NETWORK DEMANDS

### CASE STUDY

- ❑ Background, roles, project
- ❑ Strategy for next 10 years
- ❑ Operational requirements
- ❑ Network demands
- ❑ Constraints, enablers, and solutions
- ❑ WhizzieKit C, CD & T series

## MANAGING LIGHT

### HANDLING NON-LINEAR EFFECTS

- ❑ Navigating the non-linear regime
- ❑ What do we mean by non-linearity?
- ❑ Non-linear jargon SRS, SBS, Kerr effect, SPM, XPM, FWM, XpolM, NPN
- ❑ Scenarios: symptoms of non-linear effects
- ❑ Mitigation & compensation of NLE
- ❑ Using non-linear effects

### FIBRES FOR ADVANCED TRANSMISSIONS SYSTEMS

- ❑ Trends with comms systems

- ❑ Trends with conventional fibres
- ❑ Progress with radical fibres

### INS & OUTS OF TRANSCEIVERS

- ❑ Jargon & decision factors
- ❑ Choosing data rates and form factors
- ❑ Distances & transmission technologies
- ❑ Pluggables technologies for 100G, 400G, 800G...
- ❑ Module & host compatibility
- ❑ Pluggable challenges
- ❑ On board optics
- ❑ Co-packaged optics

## INCREASING CAPACITY

### USING LIGHT TO TRANSFER MORE INFORMATION

- ❑ Key concepts
- ❑ Basic modulation formats
- ❑ Phase-shifted formats
- ❑ Complex signals
- ❑ Generating optical signals
- ❑ Detecting optical signals
- ❑ What's so great about coherent detection?

### INCREASING CAPACITY

- ❑ Increasing total capacity
- ❑ Increasing baud rate
- ❑ Increasing symbol complexity
- ❑ Using polarisation multiplexing

- ❑ Using wavelength multiplexing
- ❑ Space division multiplexing
- ❑ The 10 Terabit challenge

## EXTENDING REACH

### OPTIMISING AMPLIFIER PERFORMANCE

- ❑ Using amplifiers to extend reach
- ❑ Using amplifiers to improve system performance
- ❑ Assessing L-band amplifiers
- ❑ EDFAs v Raman
- ❑ EDFA developments
- ❑ Optimising EDFA and Raman performance
- ❑ Amplifier developments

### SUBMARINE CABLE SYSTEMS

- ❑ Submarine cable systems
- ❑ Subsea cable system technologies
- ❑ SMART cable systems
- ❑ Testing subsea systems
- ❑ What the rest of us can learn from subsea systems

## INCREASING FLEXIBILITY

### DYNAMIC OPTICAL NETWORKS

- ❑ Why, what, when & how of changes
- ❑ Managing total & channel power levels
- ❑ Directing all the light or

- wavelengths channels
- ❑ Selecting wavelengths dynamically
- ❑ Changing wavelengths and spectral ranges
- ❑ Exploring dynamic modules: VOA, DCE, WSS, OCMs etc.
- ❑ Adaptive optical transceivers: Open ZR+ @ 100-400G, High end AOTs @ 800G-1.6T

### ROADMS

- ❑ ROADMs in our case study
- ❑ What can ROADMs do for you?
- ❑ Colourless, Directionless, Contentionless ROADMs, Flexgrid & openROADMs
- ❑ Specifying ROADMs

## CONTROLLING LATENCY

### CONTROLLING LATENCY

- ❑ Latency sensitive applications
- ❑ The journey
- ❑ Minimising latency for critical applications
- ❑ Calculating latency
- ❑ Measuring latency

## QUALITY OF SERVICE

### IMPROVING SYSTEM PERFORMANCE

- ❑ What performance issues might we face?

- ❑ Forward Error Correction, 2<sup>nd</sup> gen & soft-decision FEC
- ❑ Digital Signal Processing
- ❑ Electronic Dispersion Compensation
- ❑ Adaptive optical transceivers
- ❑ SDN considerations

## GOING OPEN AND INTEROPERABLE

### SOFTWARE DEFINED NETWORKING

- ❑ SDN in our case study
- ❑ SDN without the jargon
- ❑ Disaggregation & IPoDWDM
- ❑ Issues & action plan

## NETWORK DESIGN

### NETWORK DESIGN STRATEGIES & POLICIES

- ❑ Challenges and constraints
- ❑ Disaggregation and SDN
- ❑ Network management and control circuits
- ❑ Pluggable transceivers
- ❑ Data rates and transmission technologies
- ❑ Amplifiers
- ❑ ROADM deployments

## ASSESSMENT

- ❑ DCI design assignment
- ❑ Main case study assignment
- ❑ Theory assessment



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CommsLearning, founded by Andy Edwards in 2002, specialises in providing training in ICT and Telecommunications, to a broad range of clients around the World spanning the banking, retail, utilities, telco, military, airline, technology and media industries. Now based in the Asia Pacific region, Andy is the CEO and Head of Technical Delivery and is focussed on instructor-led technical training, delivering training in New Zealand, the Pacific Islands and Australia; a role that his 40+ years of telecommunications experience qualifies him well for. Andy also works with local partners across the Asia Pacific region who are able to help with specific requirements.

**Andy is licensed by Optical Technology Training to teach the OTT CONA, CFCE, CONE and Advanced OTDR courses.**