



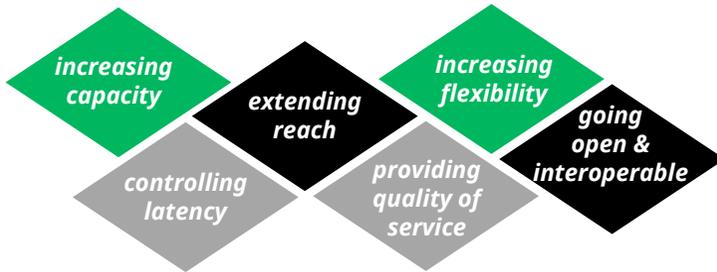
Certified Optical Network Engineer (CONE)

5 days



Purpose

The growth of the Internet, cloud services, 5G networks and a global pandemic & WFH 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. 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, 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
- ✓ 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.





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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
- ❑ Pluggable 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.

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, 2nd 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
- ❑ 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

- ❑ Case study assignment
- ❑ Theory assessment

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Why you should choose OTT's training in optical networks

OTT have 30+ years of experience in designing & developing training and certification programmes in fibre optics & optical networking. We think there are key things that make our optical networking courses the best in the world.



We are focussed on ***your real needs*** as practitioners in the industry and ***we truly believe that training must be relevant & put into context, if it is to be of real use.***

Our one priority is the provision of great training in our specific niche. That means we can approach it with a clear, independent, perspective unburdened by the marketing drivers of the big equipment or systems providers.

Our Technical Director, Richard Ednay, makes sure that everything is technically correct and as up to date as possible with current and future developments.

We put a lot of effort into producing well-structured, ***engaging, training materials and realistic exercises*** that help ease and optimise your learning and make it fun.

These are broad, generic courses so you may want to build on your learning with manufacturer, task or product specific courses, but you'll get a lot more benefit from those, if you have taken CONA and CONE first.

Why not come along and make your own judgement.



Licensing the course delivery out to partners around the world has several important benefits.

We get the time we need to concentrate on what we do best. Our partners get all the support they need so that they can focus on quality of delivery. You get regional trainers who can relate to the industry and developments in your part of the world, supported by world-class training materials.

What to expect

- ❑ course resources online, including a comprehensive course manual, with summaries and review exercises, that you can add your own notes to
- ❑ self-test electronic review questions
- ❑ on CONE take on the A to B 10 Terabit challenge! whether your A to B is within a data centre, or they are in different data centres from 80km apart to 7500km apart
- ❑ an engaging case study which tackles the technology for current deployments and strategic directions for the next 10 years
- ❑ a physical representation of WhizzieKit (on live courses) as well as the detailed WhizzieKit catalogue with specifications for planning the equipment required for your project design assignment
- ❑ customised spreadsheets to help you prepare your assignment submission
- ❑ online field guide links to help you put your learning into use in your job role



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Why you need to do the CONA course first

The CONE course is an intense, high-level, course on optical networking. You need to be able to hit the ground running. You will need a good foundation of broad-based, cohesive knowledge in order to tackle the concepts we deal with on the CONE course. We know that the CONA course can provide you with that. Frequent feedback from delegates, working in the industry, who attend the CONA course is ***"I didn't know how much I didn't know until I came on this course."***

But with OTT courses it's not just about knowing stuff, it's about putting things in context so you can solve real world issues, by having a deeper understanding of all the complex interactions.

OTT's optical networking courses use a unique approach with an on-going integrated case study and our virtual optical networking system, WhizzieKit. The CONA course introduces you to WhizzieKit & the case study. You'll really value knowing your way around the X-series as you deal with the C-series and beyond on the CONE course. You'll also be familiar with the basics of the case study, which we build on and develop further on the CONE course and use for the design assignment.

You know it's best to watch your favourite TV or movie series in order if you want to get the full picture don't you, so get on board & enjoy the ride.