Systems & Network Training

Essential 5G architecture

A 3 day training course

Save on expenses. This course is also available on your premises.

Description

This course is designed to inform the delegate about the technologies and environments to support 5G speeds and diversity in the Radio Access Network (RAN).

Exploring both fibre based and wireless solutions and how to adapt the RAN fronthaul and backhaul arenas to support the various types of services expected to be launched to fulfil the promise of 5G.

Key outcomes

By the end of the course delegates will be able to:

- ✔ Describe the main 5G technologies.
- ✔ Describe the 5G design targets
- ✔ Explain the 5G network architecture
- ✔ Examine beamforming techniques
- ✔ Consider cell capacities
- ✔ Describe Open RAN
- ✔ Describe Multi-RAT backhaul
- ✔ Explain C-RAN & LTE fronthaul
- ✔ Explore the F1 interface and midhaul
- ✔ Examine CPRI, eCPRI & Fronthaul
- ✔ Consider availability & reliability
- ✔ Describe fronthaul and backhaul security aspects.

Training approach

This structured course uses Instructor Led Training to provide the best possible learning experience. Small class sizes ensure students benefit from our engaging and interactive style of teaching with delegates encouraged to ask questions throughout the course. Quizzes follow each major section allowing checking of learning.

Details

Who will benefit?
Technical staff working with 5G

Prerequisites
Essential 5G

Duration: 3 days

Customer rating: **New course**

Generic training	Small class sizes	Hands On training	Our courseware	Customise your course
Generic training complements product specific courses covering the complete picture of all relevant devices including the protocols “on the wire”.	We limit our maximum class size to 8 delegates; often we have less than this. This ensures optimal interactivity between delegates and instructor.	The majority of our courses use hands on sessions to reinforce the theory.	We write our own courses; courseware does not just consist of slides and our slides are diagrams not bullet point text.	Please contact us if you would like a course to be customised to meet your specific requirements. Have the course your way.
“*Friendly environment with expert teaching that teaches the why before the how.*” G.C. Fasthosts	*“Excellent course. The small class size was a great benefit...”* M.B. IBM	*“Not many courses have practice added to it. Normally just the theoretical stuff is covered.”* J.W. Vodafone	*“Comprehensive materials that made the course easy to follow and will be used as a reference point.”* V.B. Rockwell Collins	*“I was very impressed by the combination of practical and theory. Very informative. Friendly approachable environment, lots of hands on.”* S.R. Qinetiq

Essential 5G architecture

Course content

5G transport
The scope of fronthaul and backhaul in 5G, 5G system connectivity, standards involved.

5G system design technologies
5G system targets, 5G technology components, network architecture, spectrum and coverage, beamforming, capacity, latency and architecture, protocol optimisation, network slicing and QoS, access and backhaul, URLLC, Open RAN, Release 16 & 17, 5G advanced,

RAN architecture
Multi-RAT backhaul, C-RAN and LTE fronthaul, 5G RAN architecture, 5G D-RAN backhaul architecture, integrating 5G within Multi-RAT backhaul, use case example - BT/EE network in the UK, 5G C-RAN - F1 interface and midhaul, 5G C-RAN - CPRI, eCPRI and fronthaul, solutions for fronthaul, small Cells in FR1 and FR2.

Key 5G transport requirements
Transport capacity, 5G radio impacts to transport, protocol overheads, backhaul and midhaul capacity, fronthaul capacity, Ethernet link speeds, transport delay, allowable transport delay, user plane and control plane latency, low latency use cases, transport bit errors and packet loss, availability and reliability. Security: Summary of 5G cryptography protection.

Analysis for 5G synchronisation requirements
Frequency error, time alignment error (due to TDD), Time alignment error (due to MIMO), time alignment error (due to carrier aggregation), time alignment accuracy (due to other advanced features)

Further 5G network topics
Transport network slicing, integrated access and backhaul, NTN in 3GPP, different access types protocol stacks, transparent architecture, URLLC services, reliability, latency. Industry solutions and private 5G, private 5G networking, URLLC and TSC in Private 5G. Smart Cities, needs of cities, possible solutions, implications for BH/FH

Fibre backhaul and fronthaul
5G backhaul/fronthaul transport requirements, capacity challenge, latency challenge, synchronisation challenge, availability challenge, software-controlled networking for slicing challenge.

Transport network fibre infrastructure
Availability of fibre connectivity, dedicated versus shared. Fibre infrastructure, dedicated infrastructure, shared infrastructure. New builds versus legacy infrastructure. Optical transport characteristics, TSN transport, network for the low-layer fronthaul, TDM PONs, Wavelength Division Multiplexing Connectivity, Passive WDM architecture.

Wireless backhaul and fronthaul
Baseline, outlook. Use cases densification and network upgrade. Architecture evolution - Fronthaul/Midhaul/Backhaul. Market trends and drivers, data capacity Increase, full outdoor, new services and slices, End-to-End automation.

Tools for capacity boost
mmWave technology below 100GHz, carrier aggregation, new spectrum above 100GHz, free space optics.

Networking services and technologies
Cloud technologies, arranging connectivity, IP and MPLS services, Traffic Engineering with MPLS-TE, E-VPN, Segment Routing, IP and optical, routing protocols, Carrier Ethernet, link aggregation, securing the network, link-layer IKEv2, DTLS.

Time sensitive networking and deterministic networks
Motivation for TSN, IEEE 802.1CM - for fronthaul, frame pre-emption, frame replication and elimination, management, deterministic networks, programmable network and operability, Software-Defined Networking initially, benefits with central controller, NETCONF/YANG.

Network deployment
NSA & SA deployments, Cloud RAN deployments, fronthaul deployments, indoor deployments, delivering synchronisation,. Evolutionary views for fronthaul and backhaul.