



# Achieving Assured and Interoperable Tactical Networking via Virtual Environments for Bigger Systems, Faster and with less Cost

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- Introduction
- Agenda
- Definitions
- The Tactical Network
- An Approach
- Introducing OCTANE<sup>©</sup>
- Scenario
- Summary

- Achieving Assured and Interoperable Tactical Networking via Virtual Environments for Bigger Systems, Faster and with Less Cost
- Defence Science and Technology Portfolio<sup>1</sup>
- Communications and Networks (C&N) Programme
  - Comms & Nets Enhancements Strategic Review Project 20
    - Autonomous Resilient Architectures (ARA) – accelerating next generation
- Three years to bring together individual previous research to support next generation at the Tactical Edge

1. UK Government Ministry of Defence's Science and Technology Portfolio: <https://www.gov.uk/government/publications/defence-science-and-technology-programmes-and-projects/ministry-of-defences-science-and-technology-portfolio#communications-and-networks>

- Digital Twin
  - A digital twin is an extension of a digital model of a real-world entity, environment or process that allows the inclusion of a right time, two-way data flow into and out of the real world (*Dstl Digital Twin Strategy V2.2 Draft dated May 23*)
- Network Simulation
  - The execution of a system model over a time (*UK Joint Service Publication 939 Defence Policy for Modelling & Simulation*) calculating the interactions between network entities, routers, switches etc (*Wikipedia dated Mar 24*)
- Network Emulation
  - Testing the performance of real applications and bearers over a virtual network (*Wikipedia dated Oct 22*)
- Common Open Research Emulator (CORE)
  - Is a tool for building virtual networks and computers (*U.S. Naval Research Labs (NRL) Code 5522 and Adjacent Link LLC*)
- Extendable Mobile Ad-hoc Network Emulator (EMANE)
  - Allows heterogeneous network emulation using a pluggable MAC and PHY layer architecture (*U.S. Naval Research Labs (NRL) Code 5522 and Adjacent Link LLC*)
- Tactical Edge
  - As the platforms, sites and personnel operating at lethal risk in a battlespace or crisis environment characterised by dependence on information systems, high threats to operation readiness of both information systems and connectivity, and users are fully engaged, highly stressed and dependant on the availability integrity and transparency of the information systems (*NATO Tidopedia*)
- Denied, Degraded, Intermittent and Low bandwidth (DDIL)

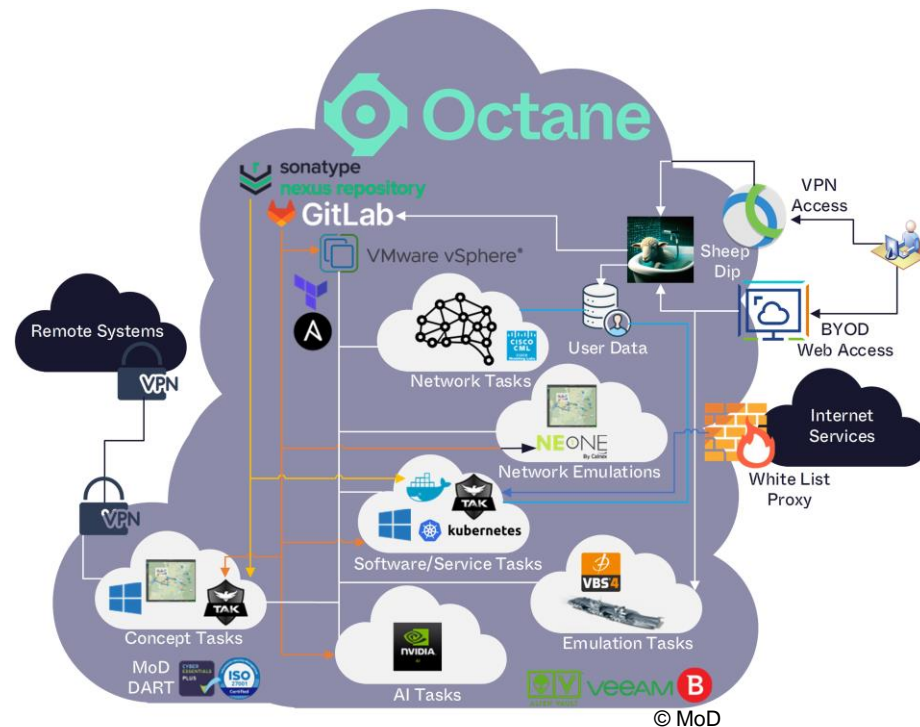
- Historically, in General
  - Voice
  - Point to point networks
  - Data through separate channels / networks
  - Beyond Line of Sight difficult or through strategic Network
  - Reporting through HQ's up across then down and not direct
  - Liaison officers with coalition embedded communications
  - Sensor integrated as part of platform
  - Bespoke military
  - System and networks separated / air gapped
  - NATO training, processes, practices dogma
- Last Decade
  - BLOS TacSat direct connection to the Edge
  - Exploitation of SWAP supporting greater data on the move
  - Gateways, One way diodes
  - Wide network connectivity
  - Standardisation of data
  - Better training processes and procedures to overcome CIS shortfalls
  - Physical has become the Virtual
  - Simulation and emulation
  - Commercial of the Shelf enablement through Military of the Shelf development
  - FMN System and Procedures
  - Greater testing over coalition assured testing network i.e. Combined Federated Battle Laboratories Network (CFBLNet)
- Today
  - Flat network
  - Software defined networks,
  - Dynamic routing multiple bearer
  - Low earth satellite providers
  - Data centric security
  - Protected core network
  - Cyber
  - Electronic magnetic warfare
  - Network and data flows have become complex
  - Not necessary mapping military order of battle and organisation
  - Concept of Digital Twin
  - Machine learning
  - Artificial intelligence
  - COTs to MOTS
  - Secure by design
  - Assurance and Validation

- Provision of simulated environment through virtual emulated networks
- CORE
- EMANE
- Exploitation of Commercial of the Shelf (COTS)
- Enterprise Open Architecture
- Widespread open source
- Cost effective
- Security, Cyber and Deception
- Support to development, security and operations

- Dstl C&N Prog, ARA Project has commissioned Antillion Ltd to provide OCTANE:

(Open C5ISR Test And Experimentation) environment

- Accelerated Research
- MoD, Government, Industry and Coalition Partners
- Accredited to Official Sensitive
- Developing secret environment
- Securely assessable over the Internet
- Multiple disciplinary collaboration
- Core/EMANE
- Service stimulators created, to exercise the services and the network.
- Background traffic loading created (not interactive with the services)
- Accessible by MoD, Industry & International Partners





- A team that provided support to the testing and integration that understands:
  - Military C5I integration
  - Doctrine, training, procedures and processes
  - Understand information exchange requirements
  - Data flows
  - Assurance & Security
  - Integration of UK / Coalition technology
  - Emerging military doctrine and technical approaches
  - The military requirement
  - The military intent
  - Small form factor
  - Military procurement
  - Government contracting
  - Accredited and accepted cross government and Coalition
  - Understood and understanding international intent
  - Military operations, deployment and working in a DDIL environment
- Bearer emulation including:
  - Military GEO and LEO satellites
  - MANET
  - VHF SNR
  - HCDR
  - HF (NB and WB)
- Hardware in the loop - Insert real radios into OCTANE, to validate fidelity
- Test emulated pLEO with real Starlink
- Data and information flows simulated currently include:
  - Email
  - Web
  - File transfer
  - SMB
  - BITS
  - XMPP Chat
- Multiple, concurrent test environments
- Bearer emulations to assist with the testing of the networks:
  - These networks are scripted so Links can appear, disappear and change characteristics (due to distance or interferers)
  - Other network components are also scripted to allow us to build up networks quickly:
    - IP Crypto, Red routers etc.
  - Scripted artefacts available to other tasks, for shared use

- **Military Systems Information Assurance (MSIA) Phase 2**
  - Zero trust data centric security across a Generic Vehicle Architecture (GVA)
- **Autonomous Resilient Architectures (ARA)**
  - Self Coordinating CIS Postures
  - Resilient Information Services
  - Adaptive Applications
  - Coalition interoperability
- **Machine speed C2 (MCS2)**
  - Project, is intended to address the framework, or architecture required to enable Human Agent Collectives (HAC) in a Generation After Next Command and Control (C2) Enterprise.
- **Multi Domain Integration (MDIS)**
  - The goal of the MDIS project is to form the basis of future multi-domain integration projects and to also inform the Campaign Advantage requirements in the 2025 integrated review
- **Bright Corvus WP3**
  - Bright Corvus Work Package 3 will develop a variety of next-generation and generation-after-next Technology Concepts and mature them for a live demonstration. It is focused on advanced RF sensing and effect technologies.
- **Intelligent Ships Phase 3**
  - Developing concepts for Human-Autonomy Teaming, focusing on Naval Platform Command and control. Bringing in multiple AI/ ML agents into a collaborative AI system.
- **Data Centric to Network Centric Security**
  - Provision, development and testing of Data Centric Security at the Enterprise to the Tactical Edge with current network centric security networks.



© MoD

Restricted Internet Provided Military Cloud - Relatively £ per test



© MoD

Secret Cloud or current international convexity with hardware in the loop ££ per test



© MoD

Platform integration and assurance and live testing £££

- Not really new, however from a cost benefit factor a lot more viable
- Not about the technical cloud service but the technical integration support
- Persistent whilst maintaining a degree of security
- Support DevSecOps and development MOTS capability
- Provides government to industry to coalition testing environments
- Supports secure by Design

# **[dstl]** The Science Inside

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