NORTH ATLANTIC TREATY ORGANIZATION
ORGANISATION DU TRAITÉ DE L'ATLANTIQUE NORD

NIAG Study Group 287

Collaborative Environment for Next Generation Combat Air Platforms and Networked Weapons

Study Chair: Mr Paramjit Matharu FRAeS (UK)

Date: **03/09/2024**

NATO Industrial Advisory Group (NIAG) Overview

The NIAG is a high-level consultative and advisory body of senior industrialists of NATO member countries, acting under the Conference of National Armaments Directors (CNAD), with the aims of providing a forum for free exchange of views on industrial, technical, economic, management and other relevant aspects of research, development and **production of armament equipment within the Alliance.**

NATO

- Get understanding of opportunities associated with technology trends and technology maturity levels and roadmaps, etc.
- Get insight into business models, production timelines, standards, required skills and potential industry partnering opportunities, etc.
- Get informed on Capability Development by the NIAG, a NATO body
- Get informed on potential collaborative opportunities for research, development and production of military equipment and weapons systems

Through the NIAG in the non-competitive/pre-procurement phase

Industry

- Receive early visibility of capability planning and funding sources, allowing to make strategic forward investment decisions, etc.
- Understand operational requirements and end-use of technologies
- Learn from operational experiences in the field
- Network with other industries and understand future industry business & cooperation opportunities

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NIAG Overview – Funding

Pre-competitive phase

NATO-accredited
Centres of Excellence

NATO OTAN **Emerging Security Challenges Division**

≈ $2.25M/yr

S&T organization

Science & Technology Organization (STO)
≈ $330M
through Nations

ACT's FFCI / OCAI + IH
(Office for Collaboration with Academia and Industry + Innovation Hub)

CNAD CDNA — Reports to → NATO INDUSTRIAL ADVISORY GROUP NIAG ≈ $4.5M/yr

Competitive phase

NSPA NATO SUPPORT AND PROCUREMENT AGENCY

≈ $4.6B/yr
32,700 POs in 2019 (biggest one was €28.6M for CH-53 Spare Parts)

NCI AGENCY

$720M to $1.2B/yr

ALLIED COMMAND TRANSFORMATION > $10M/yr

ACO SHAPE NATO OTAN > $50M/yr

To be monitored: NATO DIANA & NATO Innovation Fund developments

From (1) informal dialogue to (2) S&T collaboration to (3) studies/workshops/conferences/demonstrations to (4) sales to (5) sustainment to (6) disposal

- Aim: ensure the highest level of contribution (1) to warfare development; (2) to the support of NATO exercises and operations; and (3) interoperability
- Ultimately, this industry-NATO framework contributes to the enhancement of NATO's overall capability development and acquisition
- NATO Member Countries' total spent (2020e): on O&M => $320B + on Major Equipment (incl. R&D) => $282B. So, NATO bodies spent only 1% of this amount!

NIAG Tasking

- Sponsoring entity: **NATO Air Force Armaments Group (NAFAG) - ACG/2**

- Study objectives:

  - Identify the technologies and standards which should be used to ensure a collaborative (interoperable) environment for NATO's next generation of Air Combat platforms and weapons

  - Focus on technical aspects of a combat cloud that will enable sensor-to-shooter kill chains in multi-domains (air, space, cyber) environments

  - A feasibility analysis of Mesh Network (MANET) technology to allow AI-enabled NEW to communicate with third party controllers
    - Network security, protocols, data tagging packaging

Address 6th Gen Interoperability Challenges – NGAD – EuFCAS – GCAP

Study Management Team

- Chair: Paramajit Matharu – RTX (UK)
- Vice-Chair: Fotios Katsilieris – Airbus Defence and Space GmbH (DEU)
- Vice-Chair: Pierrer-Yves Benzakine – Thales France (FRA)
- Rapporteur: Rob Munday - IBIC (GBR)

Study Group Participating Companies

Finland	Insta Advance Oy
Finland	Patria
France	Airbus Defence and Space SAS
France	Dassault Aviation
France	Gore
France	Thales
France	Thales Avionics France SAS
France	Thales LAS France
France	Thales SA
France	Thales SIX GTS FRANCE
Germany	Airbus Defence and Space GmbH
Germany	Airbus Helicopters
Germany	Diehl Defence GmbH & Co. KG
Germany	ESG -GMBH
Germany	Hensoldt
Germany	MBDA Deutschland GmbH
Germany	MBDA Germany
Germany	PBS GmbH

Germany	QinetiQ GmbH
Germany	T-Systems Information Services GmbH
Italy	ADC2 - Aerospace & Defence Consultancy
Italy	Elettronica SpA
Italy	Leonardo
Italy	Leonardo Helicopters
Italy	MBDA IT
Italy	Roketsan
Portugal	Grey Moose
Spain	Clue Technologies
Spain	E&Q Engineering
Spain	GMV Aerospace & Defense
Spain	Indra
Spain	SENER Aeroespacial S.A.
Sweden	Saab AB
Turkiye	Aselsan
Turkiye	Havelsan AŞ
Turkiye	Meteksan Defence

Turkiye	Tubitak Sage
Turkiye	Turkish Aerospace
United Kingdom	Adept Aviation Solutions Ltd.
United Kingdom	Ascalon Defence
United Kingdom	BAE Systems
United Kingdom	Collins Aerospace
United Kingdom	GE Aerospace
United Kingdom	Gore
United Kingdom	IBIC
United Kingdom	Leonardo UK
United States	AWS
United States	BAE Systems, Inc.
United States	Collins US
United States	Gore
United States	Honeywell
United States	Lockheed Martin
United States	Lockheed Martin - Sikorsky

10 Nations

53 Companies

128 SMEs

SG-287 Collaborative Environment for Next Generation of Air Combat Platforms and Weapons

SG-287 Study Teams

Team 1 - (OBJ2) - Operational Concepts and Scenarios for next generation Air Combat platforms, as wel as any platform that can deliver networked enabled weapons

Team 2 - (OBJ1) - Identify the technologies and standards which should be used to ensure a collaborative environment for NATO's next generation of Air Combat platforms and weapons

Team 3 – (OBJ3) – Tactical combat cloud that will enable these assets to operate in a multi-domain environment when they enter service

Team 4 – (OBJ4) – Provide recommendations on how a mesh network (MANET) would be fielded and how in-flight target updates from a third party controller would be conducted

SG-287 Collaborative Environment for Next Generation of Air Combat Platforms and Weapons

SG-287 Study Team

Team 1

Operational context

- Scenarios
- Missions and operations, including weapons families
- Required operational capabilities to accomplish the missions

Team 2

Tech. & standards to enable CC capabilities

- Covers both user-facing and back-end capabilities
- Transversal input to Teams 3 & 4

Team 3

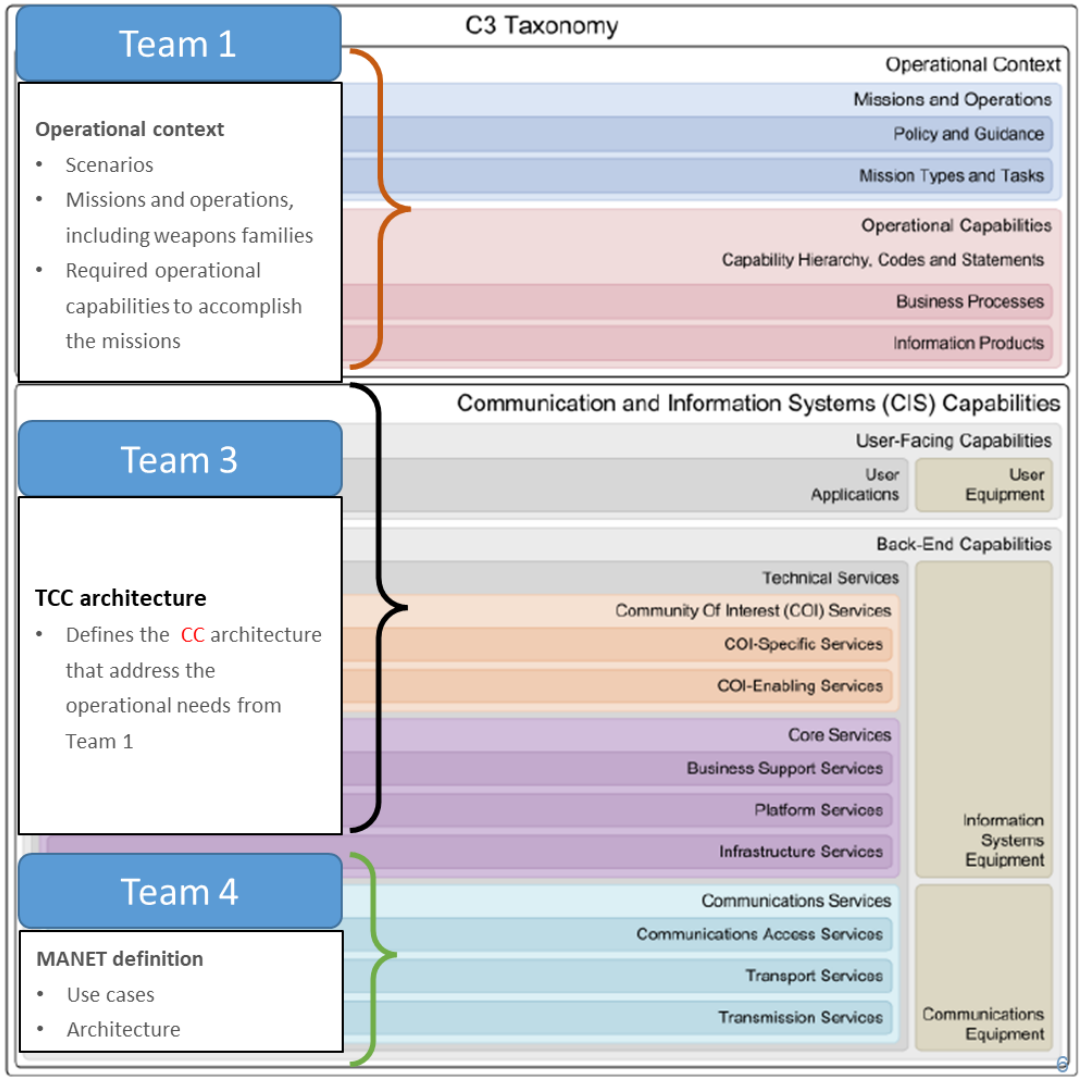
TCC architecture

- Defines the CC architecture that address the operational needs from Team 1

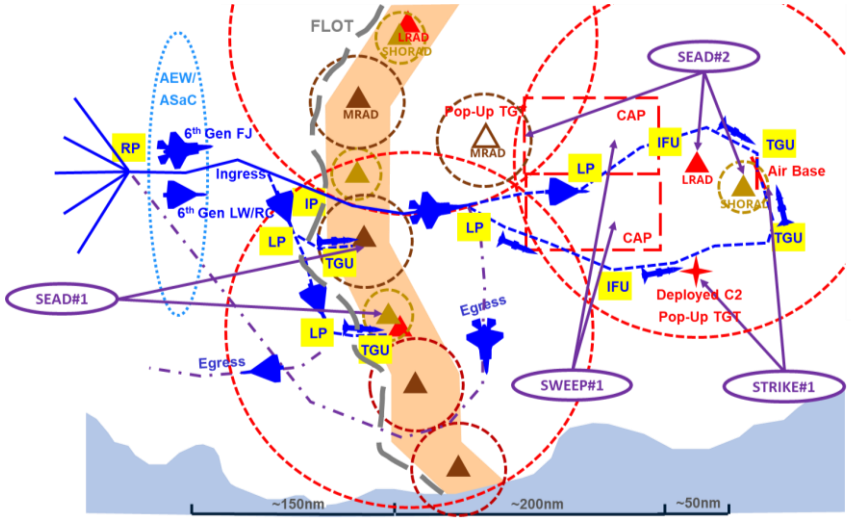
Team 4

MANET definition

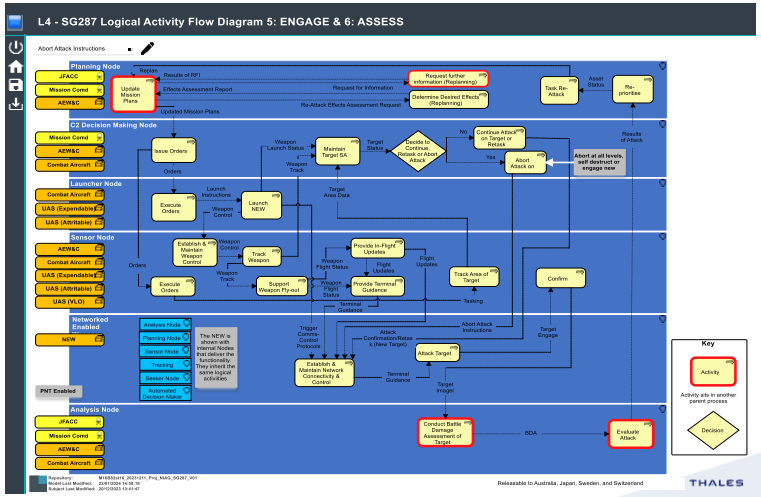
- Use cases
- Architecture



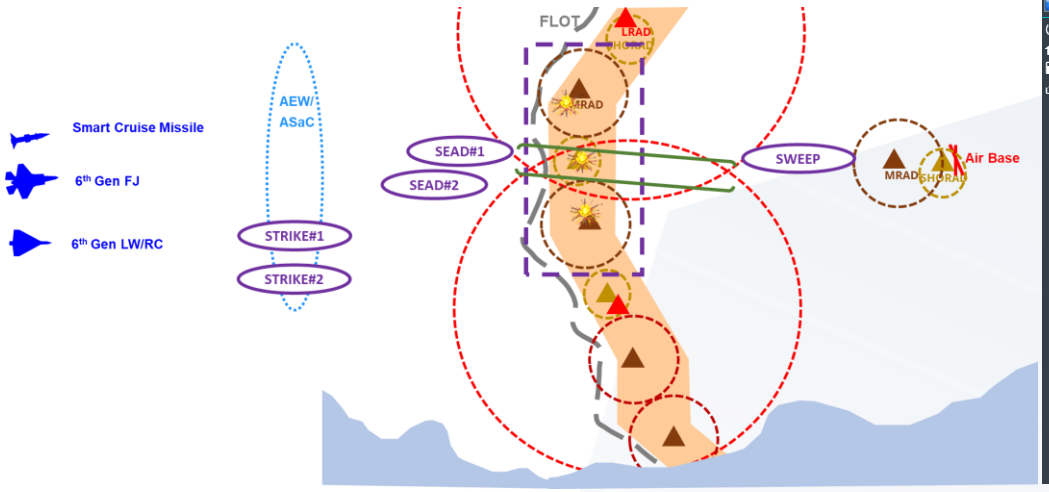
SG-287: Collaborative Environment for Next Generation of Air Combat Platforms and Weapons
2035 OCA Use Case (Launch, Handover, Execute) Graphics and NAFv4.0 Views (Team 1)



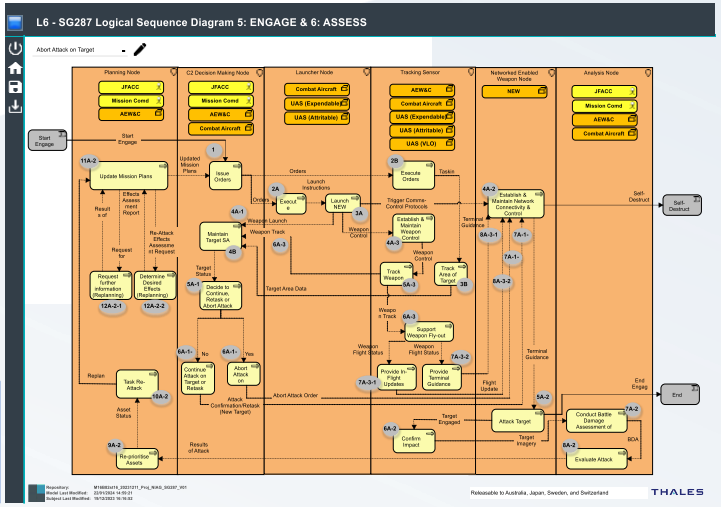
Baseline Use Case Whiteboard (6th Gen)



Logical Activity (L4) Engage & Assess



Phase Graphic: SAMBELT Engagement



Logical Sequence (L6) Engage & Assess

Time	Activity
T0	SWEEP enters red territory (first VLO UAS followed by 6th Gen. Fighters, 40 Nm in trail) VLO UAS penetration 5 min in advance from 6th G. Fighters to set an ambush for Red CAP
+2 mins	SWEEP refreshes the CROP, notably SAM Belt when heading to the Red CAP
+8 mins	6th Gen. Fighters/VLO UAS ready to engage red CAP Red CAP commits on 6th Gen. Fighters (detection from SAM Belt)
+10 mins to +15 mins	SWEEP engages Red CAP
+15 mins	Red CAP destroyed 2 x UCAV remain in the SWEEP role with 6th Gen. Fighters 2 x UCAV re-join red airbase area to perform Electronic Order of Battle update and contribute to final guidance for NEW Refreshment of the CROP for the rest of the package
+16 mins	
+20 mins	SEAD #1 and #2 strike SAM Belt and open a corridor - Refreshing of SAM DMPIs positions from all available sensors - 4 x 4th Gen. Fighters firing 10 x ARM and 12 x 125kg - 2 x 6th Gen. Fighters providing final guidance for NEW
+23 mins	SEAD #1, STRIKE #1 and #2 enter red territory. SEAD #2 holds at the border to maintain open corridor (remaining armaments are 2 x ARM and 4 x 125kg)
+25 mins	MRSAM Pop-Up, 25 Nm after corridor exit (50 Nm from middle SAM Belt)
+27 mins	SEAD #1 engages MRSAM Pop-Up: - 2 x 5th G. Fighters + 1 x Attritable UAS shoot 3 x ARM to have Pop-Up SAM go silent or die - If MRSAM Pop-Up go silent, 2 x Attritable UAS head at Pop-Up position to release 4x125 kg GB / SLA each - Bombs and ARM perform coordinated attack on Pop-Up SAM position and respective DMPI's

Use Case Timeline

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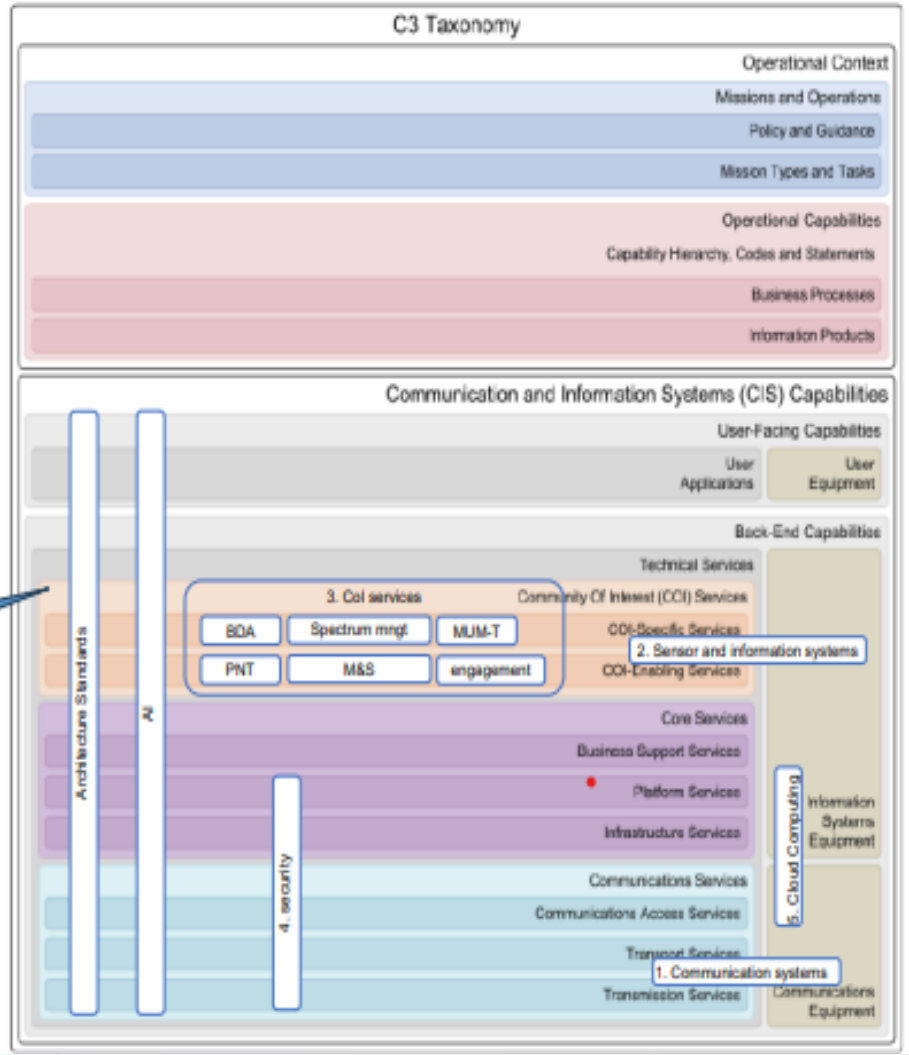
Baseline Scenario Derived Technical Areas and Standards of Focus (Team 2)

- Major steps
  - From the sequence of Events:
    - Identify needs related to NEW for EACH domain
    - Trace with C3 taxonomy services
  - From the needs
    - Identify technologies for EACH domain
    - Consolidate technologies with rest of Teams
    - Fill the technology tables



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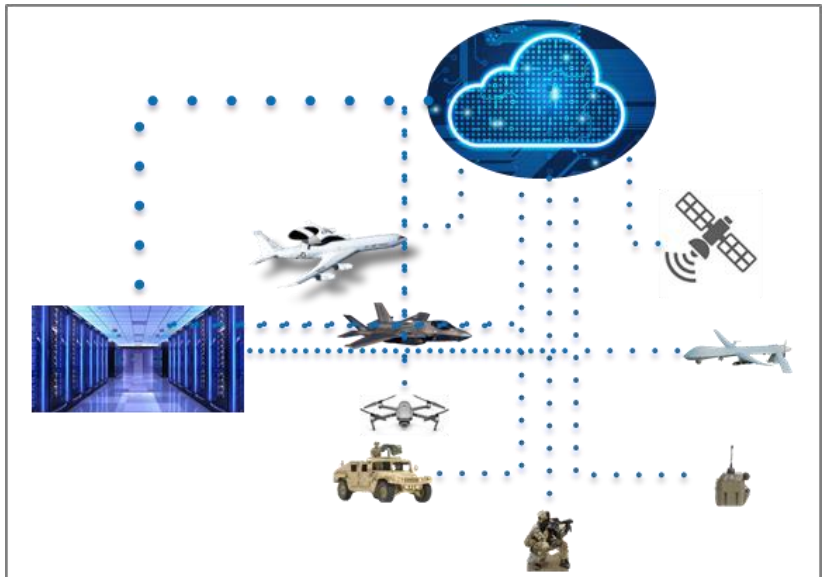
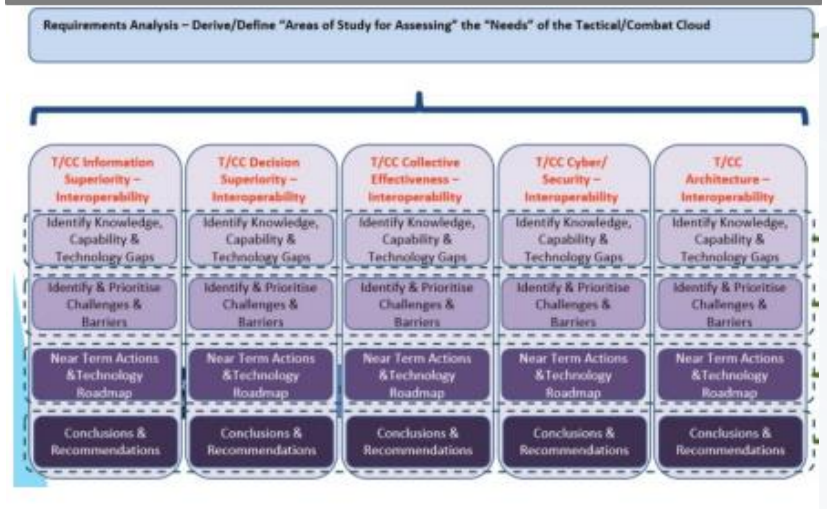
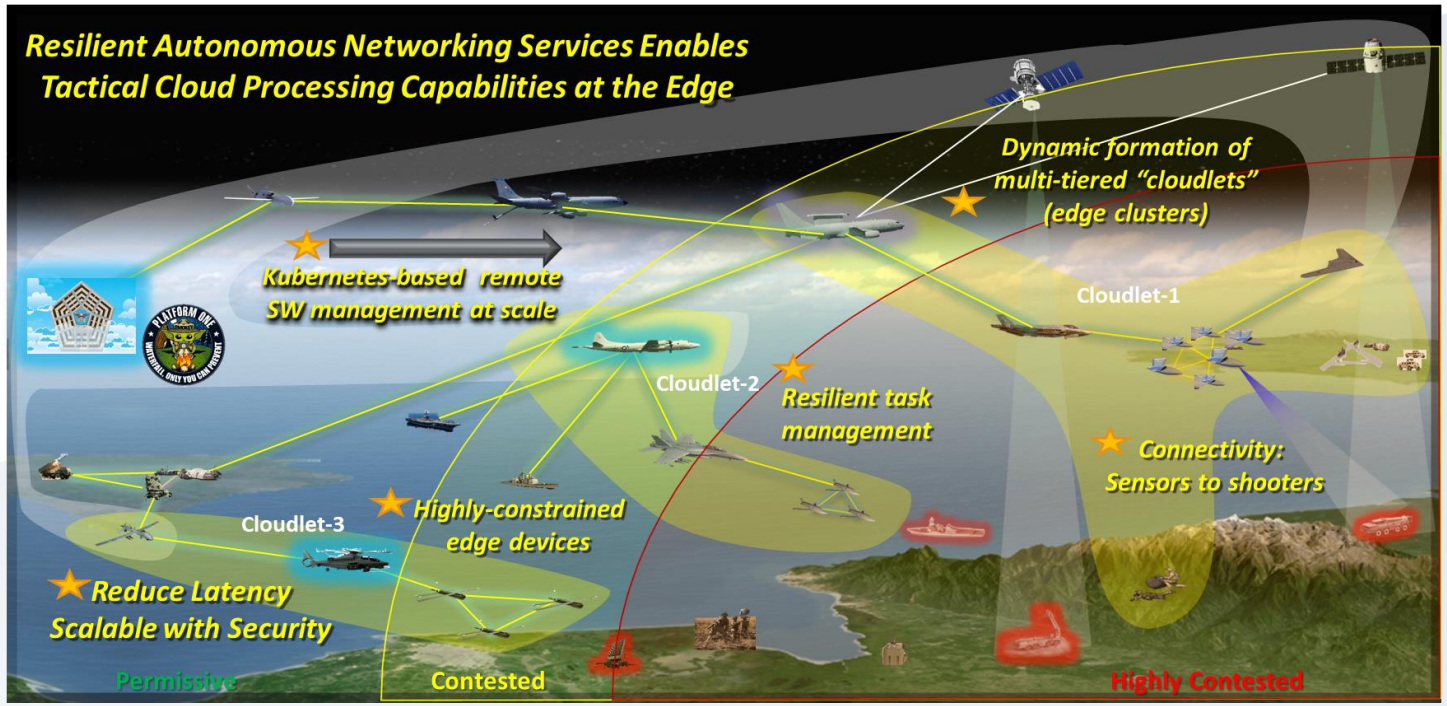
Combat Cloud – Tactical Domain





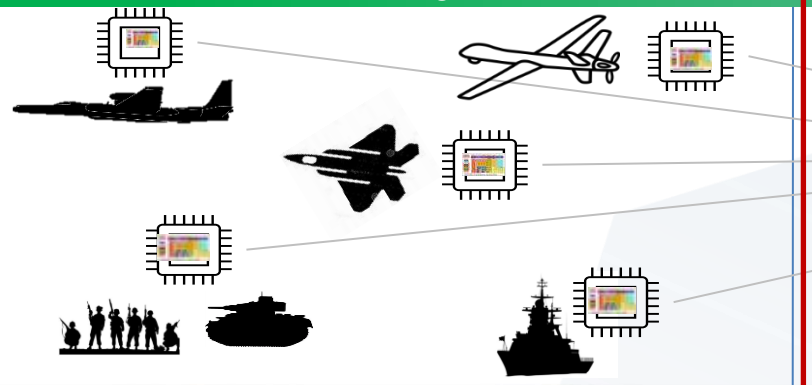


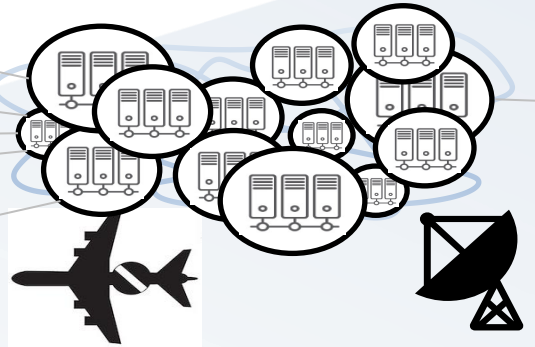
THE RELEVANCE OF RESILIENT AUTONOMOUS NETWORKING SERVICES

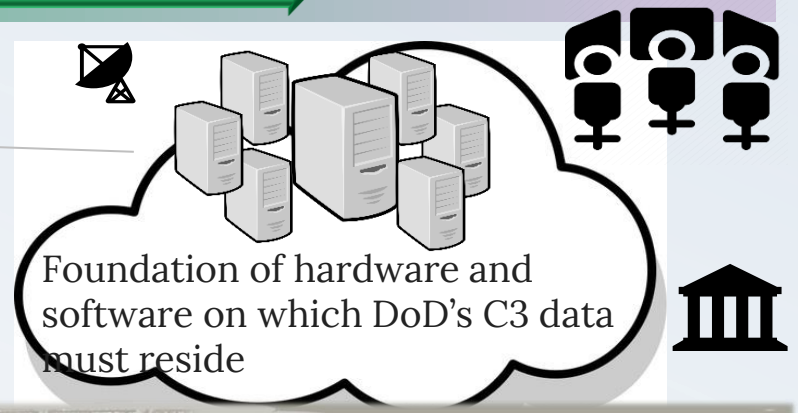
Tactical Air & Surface	Operational C2 Nodes	Strategic Ops Centers
Resilient Connectivity	Resilient Connectivity	Resilient Connectivity
Links: Tactical Comm and Satellite Connectivity	Links: Tactical Comm and Satellite Connectivity	Links: Fiber, Commercial and Satellite Connectivity
Networking: Edge Networking	Networking: Hybrid Networking	Networking: Enterprise Networking
Highly Contested – Resilient Communications Required	Moderately Contested – Defend and Evade	Contested → Permissive – Highly Defended

Enterprise Services / Cloud-based Services

Resilient Autonomous Networking Services







Fighters/UAS/HELOS/Weapons/ Surface Forces

C2 Nodes / Remote Operations Centers

Fixed Infrastructure & Operations Centers

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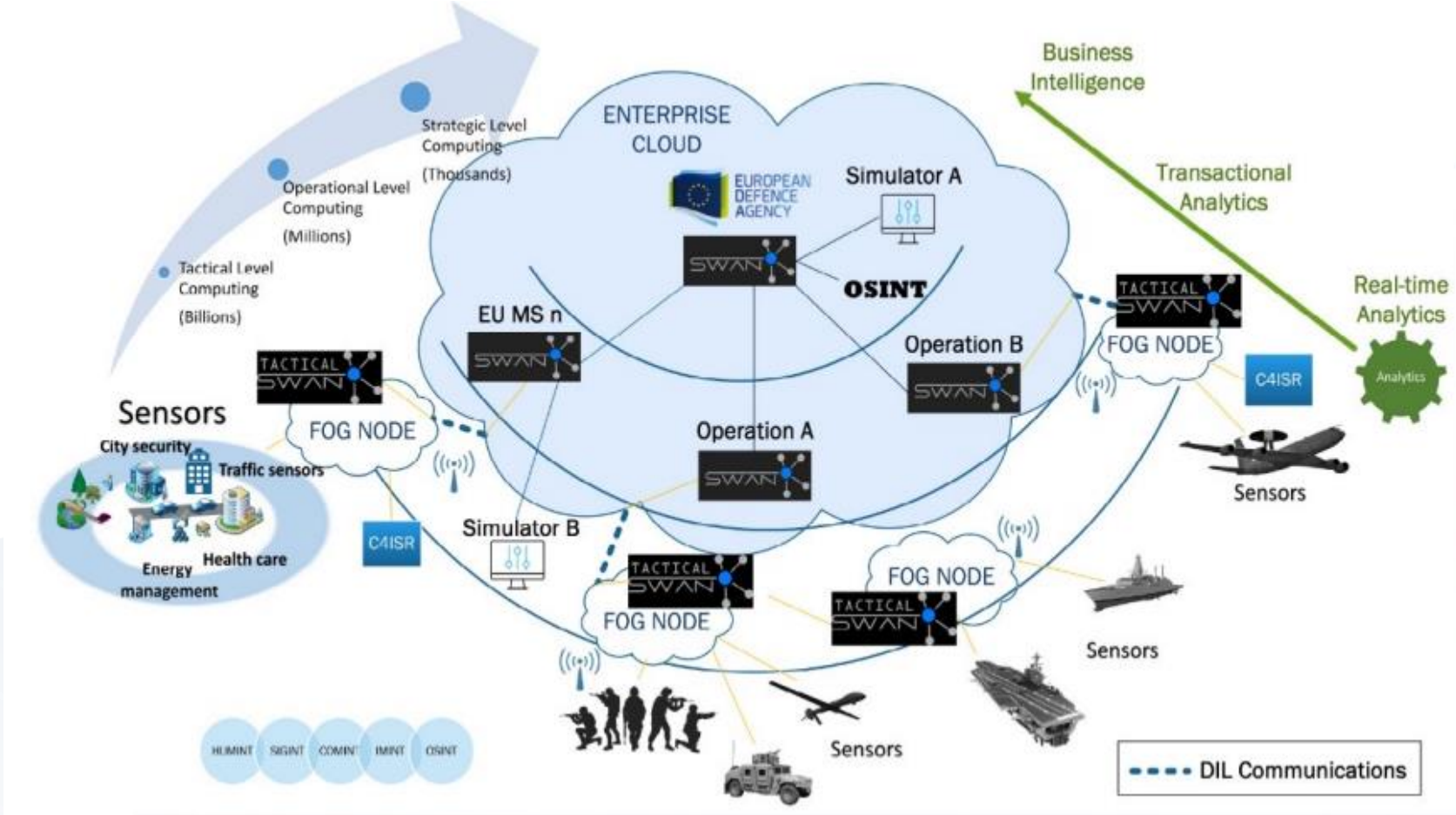
Tactical MESH/MANET – (Team 4)

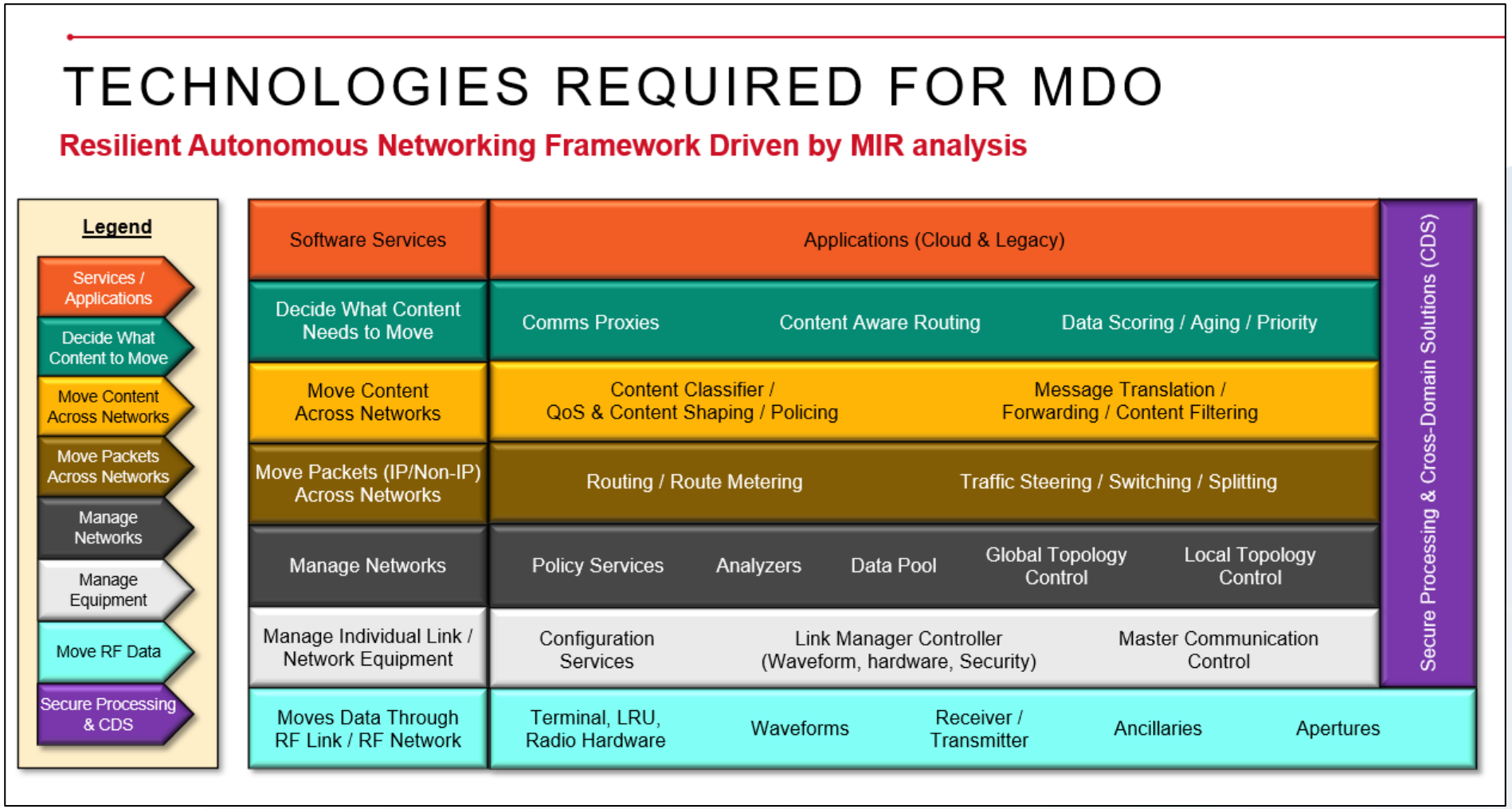
A feasibility analysis of Mesh Network (MANET) technology to allow AI-enabled NEW to communicate with third party controllers

- Intra-Flight Data Link (IFDL)
- Multifunctional Advanced Data Link (MADL)
- Tactical Targeting Networking Technology (TTNT)
- Situational Awareness Data Link (SADL)
- Small Unmanned Airborne Systems Digital Data Link (SUAS DDL)
- Advanced Digital Data Link (ADDL)
- Cooperative Engagement Capability (CEC)
- CNR with Mil-Std-188-220
- Cursor on Target (CoT) over IP networks (such as MANETs)
- JREAP over SATCOM & IP networks (such as MANETs) Various – FCAS/GCAP



Convergence - Network Access, Resilience, Autonomy, Cyber Security, Protocols, Data tagging, Data packaging

- Services Based Approach



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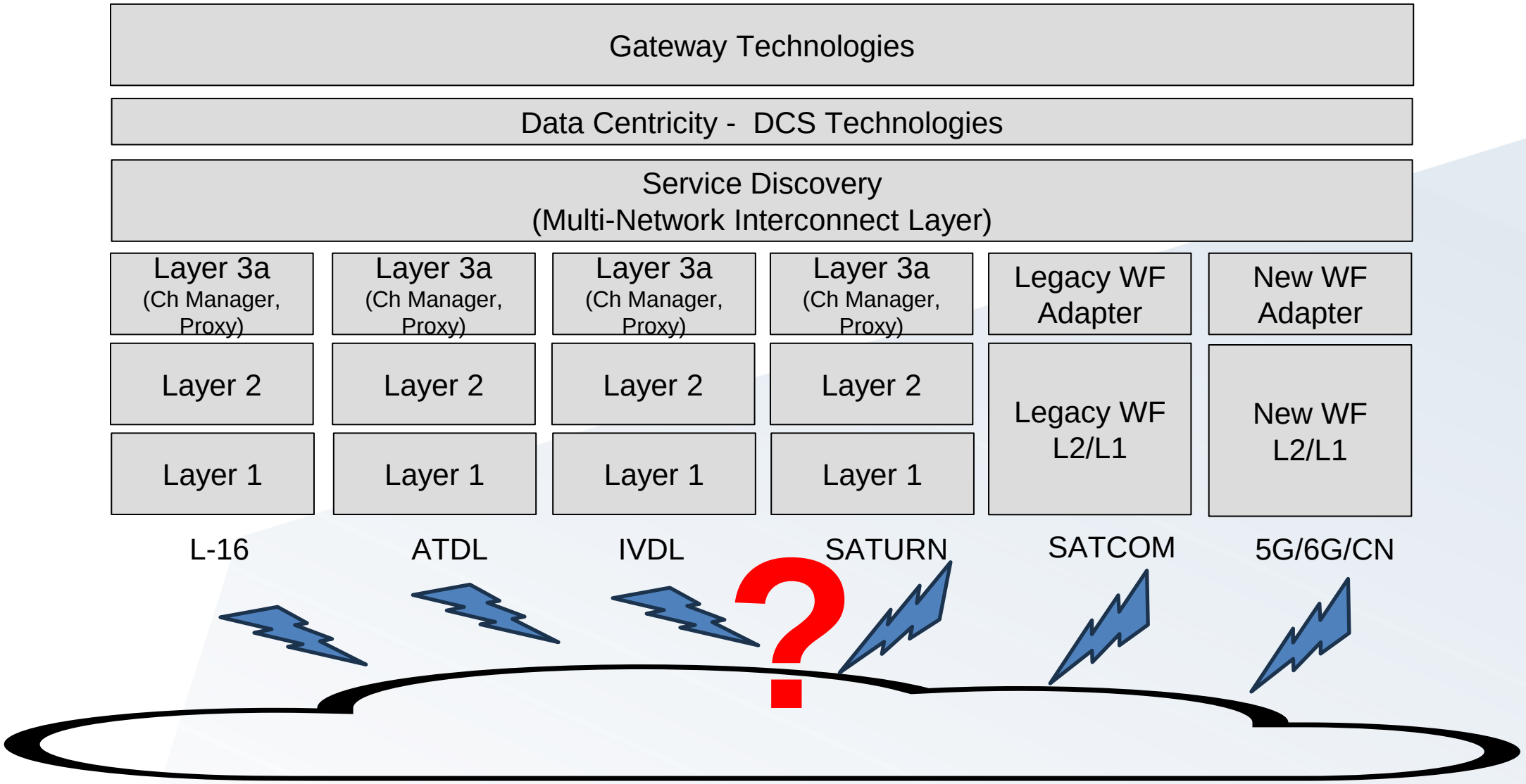
Tactical MESH/MANET – (Team 4)



Summary

- Builds On previous NIAG studies on IP Datalinks and Networked Enabled Weapons) (158, 257) and centred current thinking on SD-WAN and Combat Cloud technologies
- Goal to identify appropriate Tech Standards to enable interoperability in 2035 epoch – (AI/ML, CC, MANET, DCS, ZTA)
- Analysis of TCC,MB-DLs, Intelligent Gateways and SDN/SD-WAN concepts
- Validation of CONOPS to support 6th Gen capabilities (SWARMs, Human/Machine Teaming, Smart Weapons, Autonomy, Agile/Machine Speed C2)
- Recommendation Areas:
- 1) NATO Interface Layer Specification development based on RAN
- 2) Interoperable Bearer Standards
- 3) Interoperability Experimentation (Gateway)
- Final Study Report due in Sept 2024

- For further details
  - Chair – Mr Paramijit Matharu - e-mail: parmi.matharu@collins.com