MULTILATERAL INTEROPERABILITY PROGRAMME

MIP Technical Interface Design Plan (MTIDP)

21 March 2006, Greding, Germany

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Change tracking for the MTIDP is implemented in ANNEX X – CHANGE TRACKING

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1 INTRODUCTION

The application of military force in the early 21st century is demanding. It covers a wide spectrum of threats and deployment scenarios that range from conventional general war through limited operations, crises response operations, asymmetric conflict, and terrorism. Unilateral capability is important to nations but most planning is made on the assumption of alliance and coalition operations in scenarios that are difficult to predict and which often arise at short notice. Thus the nature and composition of a force structure to meet military requirements will be specific to requirement and based upon a general and flexible military capability.

To achieve this, an assured capability for interoperability of information is essential. The successful execution of fast moving operations needs an accelerated decision-action cycle, increased tempo of operations, and the ability to conduct operations within combined joint formations. Commanders require timely and accurate information. Also, supporting command and control (C2) systems need to pass information within and across national and language boundaries. Moreover, tactical C2 information must be provided to the operational and strategic levels of command including other governmental departments. Additionally, forces must interact with non-governmental organisations, including international aid organisations.

The Multilateral Interoperability Programme (MIP) aims to deliver an assured capability for interoperability of information to support joint / combined operations.

1.1 Multilateral Interoperability Programme (MIP)

The aim of the Multilateral Interoperability Programme (MIP) is to achieve international interoperability of Command and Control Information Systems (C2IS) at all levels from corps to battalion, or lowest appropriate level, in order to support multinational (including NATO), combined and joint operations and the advancement of digitization in the international arena

The means to achieve this is known as the MIP solution. This is a set of items delivered by the MIP programme at the end of each block[1]. It includes the MIP specifications, Standard Operation Procedures and other documentation that is required for implementation of the specifications and for use of the MIP Common Interface (MCI)[2].

1.2 The MIP Concept

The MIP solution enables information exchange between co-operating but distinct national C2 systems.

It is not within the scope of programme to specify the end system (C2IS) functional capabilities however the MIP solution has proven to be a valuable source for national C2IS development. Key to this is the fact that national systems need not necessarily conform to any hardware or software standard. Typically systems will be acquired through national or NATO acquisition programmes and their architecture will conform to the national or NATO policy prevailing at the time.

The core of the MIP solution is the C2 Information Exchange Data Model (C2IEDM). It is a product of the analysis of a wide spectrum of allied information exchange requirements. It models the information that joint combined component commanders need to exchange.

The MIP solution enables C2IS to C2IS information exchange and allows users to decide what information is exchanged, to whom it flows, and when.

The concept for the overall end state is such that when the joint combined force can operate as a single, synchronised team in accomplishing its assigned mission in the modern battle space, MIP has achieved its target. In order to achieve that synergy, a common understanding between commanders within a combined joint force conducting military operations is required. The MIP contribution to this end state is to facilitate the timely flow of accurate and relevant information using the Information Exchange Mechanisms (IEMs), specified within MIP, between the

[1] The overall MIP Calendar is divided into 'Blocks' or evolutionary solutions, each block allocates three years for development and will remain 'in-service' for two years.

[2] The MCI is a logical description of the configuration of two or more implementations (in Software and/or Hardware) of the MIP specifications that enables information exchange between two or more C2IS of different nations.

different national C2IS. MIP will, therefore, be one of the factors contributing to the realization of Network Enabled Capabilities for the commanders within a combined joint force.

MIP Baseline 1 comprises:

- The Message Exchange Mechanism (MEM) consists of a suite of formatted messages that conform to AdatP-3 Part 1, plus guidelines for their use.
- The Data Exchange Mechanism (DEM) is an automatic data push mechanism that co-exists with the MEM. When a C2 application changes the state of information that it holds, and which is recognised by the DEM, this information is automatically replicated to all other co-operating systems that have agreed to exchange this information.

With both exchange mechanisms the meaning and context of the information is preserved and requires no additional processing on receipt to make it useful. The MIP specifications enable interoperability at Degree 4.a[3] (DEM) and 2.h[4] (MEM) and functions at NATO Level 5 of System Interconnection[5].

The MIP Baseline 2 uses an improved version of the DEM for data replication. The improvements are based on the use of the latest version of the ATCCIS Replication Mechanism, the reduction of bandwidth requirements, the use of a more granular information exchange contracts in a way similar to block 1 MEM messages and by prioritising the information flows. The MEM is used for writer to reader messages only (not for data replication).

In future Baselines, MIP will be expanded to extend the panoply of interoperability services provided (messaging, Web, Directory, Security, collaboration…). The requirements for which have been captured in the MTIR and it will be the road map for the future, which will allow a graduated incorporation of improvements into subsequent baselines.

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[3] *The NATO Policy for C3 Interoperability* [NC3B Sub-Committee AC/322 SC/2-WP/72 (Revised) Version 4.3]: "Seamless Sharing of Information: Common Information Exchange."

[4] *The NATO Policy for C3 Interoperability* [NC3B Sub-Committee AC/322 SC/2-WP/72 (Revised) Version 4.3]: "Structured Data Exchange: Data Object Exchange"

[5] STANAG 5048 - *The Minimum Scale of Connectivity for Communications and Information Systems for NATO Land Forces* (Edition 5. Promulgated 16 February 2000 by NC3B Sub-Committee AC/322 SC/1). "Two systems which are open to each other, and which conform to minimum standards for information definition and transfer such that there are no fixed constraints on the extent of access by users of one system to the other, but dynamic constraints are applied to each system, in accordance with the current operational situation, such that only a user-defined subset of the total information base of one system is available to the other."

The Programme has gone through the stages of: operational analysis, concept, feasibility, definition, development and demonstration.

The programme is tightly focused on delivering capability to the warfighter in an incremental manner with the intent to achieve a 2-year delivery cycle.

In parallel the previous baselines are sustained, new operational requirements are analysed, new capabilities are agreed, and emerging technologies are explored. The baseline delivered in each cycle will be in-service for the following two years in order to encourage nations to align their acquisition cycles with the agreed implementation schedule to gain maximum benefit.

1.3 History

The Multilateral Interoperability Programme was established by the Project Managers of the Army Command and Control Information Systems (C2IS) of Canada, France, Germany, Italy, the United Kingdom and the United States of America in April 1998 in Calgary, Canada.

MIP replaced and enhanced two previous programmes: BIP (Battlefield Interoperability Programme) and QIP (Quadrilateral Interoperability Programme). The aim of these programmes was similar to the present MIP but each was active at a different level of command.

In 2002 the Army Tactical Command and Control System (ATCCIS) programme merged with MIP. ATCCIS was founded in 1980 to see if interoperability could be obtained at reduced cost and developed according to technical standards agreed by Nations and prescribed by NATO. The programme sought to identify the minimum set of specifications, to be included within national C2 systems that would allow interoperability between them. With the publication of ATCCIS Baseline 2 the programme's mandate was complete. By 2002 the activities of ATCCIS and MIP were very close, expertise was shared, and specifications and technology was almost common. The merger of ATCCIS and MIP was a natural and positive step and this was recognised by the almost immediate publication of a NATO policy that endorses MIP6.

MIP has a strong NATO buy in reinforced by the signing of a Memorandum of Agreement (MOA) between the MIP and NATO Data Administration Group (NDAG) stating their intent to

[6] NATO Policy on the Multilateral Interoperability Programme [NC3B AC/322-WP/0238]

collaborate data modelling efforts in order to produce a Joint Consultation Command & Control Information Exchange Data Model (JC3IEDM) in 2008.

1.4 MIP Organisation

The MIP programme is not a formal NATO programme. Rather it is a voluntary and independent activity by the participating nations and organizations. The nations and HQs that are active in the MIP programme are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Turkey, United Kingdom, United States, Regional Headquarters Allied Forces North Europe (RHQ AFNORTH) and Allied Command Transformation (ACT)

The MIP consists of Full Members7 (nations only) and Associate Members8 (nation and non-nation entities).

MIP is organised into 7 working groups with an executive management body and a high level steering group for resources, policy and targets. At the working group level, the Multidisciplinary Working Parties (MDWP) with experts from the various Working Groups is the paradigm. These MDWPs can be created at the behest of either the PMG or MSG for particular tasks and will draw their resources from the existing working groups.

Rigour is maintained by the adoption of recognised system engineering practices. In addition to the interface specification and the exchange mechanisms, MIP also produces supporting products covering programme management, security policy, test schedules, configuration management, representative data fills, and international liaison.

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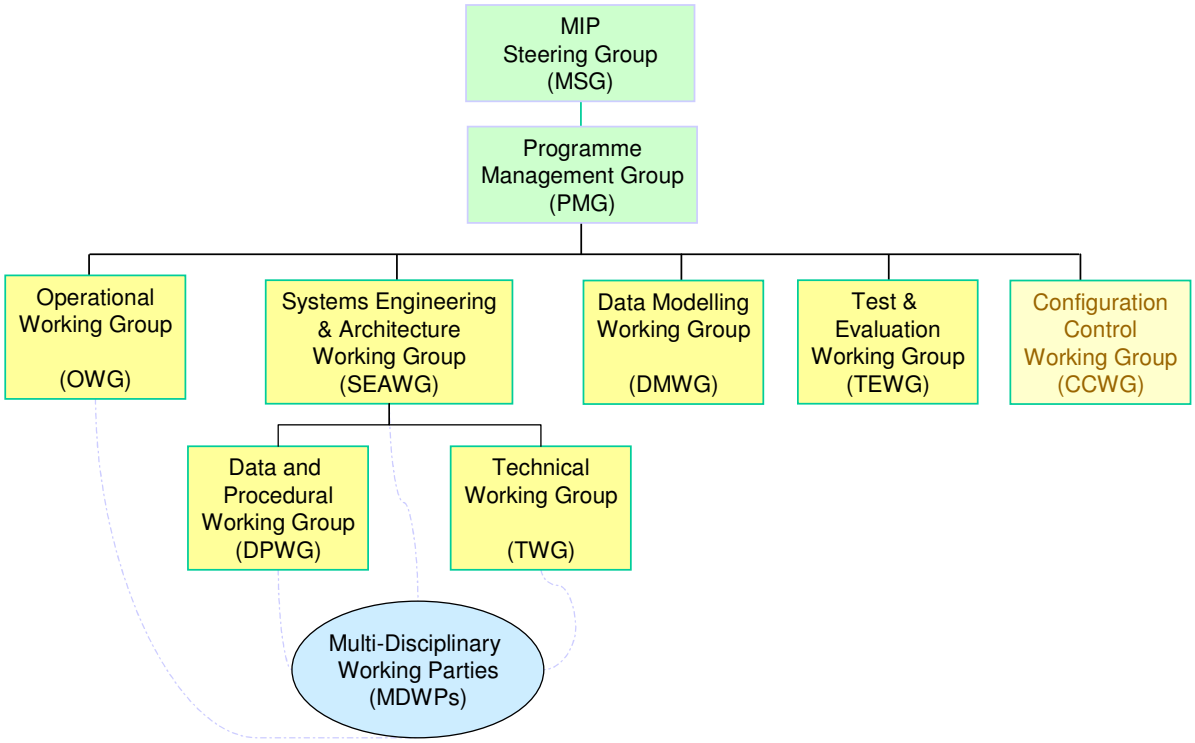
[7] Full Members are nations that commit to support the collaborative development of succeeding versions of the MIP interoperability solution suitable for fielding. In addition a Full Member must express an intention to field the MIP solution. Full Members undertake to be represented in all WGs and must be prepared to expend the resources required to develop and sustain the MIP solution. A Full Member must be involved in and contribute actively to the decision-making process throughout the specification and development cycle. In addition, a Full Member is a nation that has signed the MIP Statement of Intent (SOI) regarding their participation in MIP. Full Members have voting and access rights at all meetings.

[8] Associate Members include nations and non-nation entities such as military agencies and formations, showing an interest in this programme, which have been granted Associate Member status by the MIP Steering Group (MSG). Associate Members enjoy all the rights and privileges of a Full Member as agreed by the MSG except Associate Members do not have any voting rights at meetings. Associate members need not to support all MSG/PMG and WG meetings. In addition, Associate Members accept the MIP Statement of Intent (SOI).


MIP
Steering Group
(MSG)
Programme
Management Group
(PMG)
Operational
Working Group
(OWG)
Systems Engineering
& Architecture
Working Group
(SEAWG)
Data Modelling
Working Group
(DMWG)
Test &
Evaluation
Working Group
(TEWG)
Configuration
Control
Working Group
(CCWG)
Data and
Procedural
Working Group
(DPWG)
Technical
Working Group
(TWG)
Multi-Disciplinary
Working Parties
(MDWPs)

1.5 Implementation, Adoption and Stability

The MIP is involved in the following activities and standards:

- The LC2IEDM, is the core of the NATO Reference Model and is also a view model of NATO Corporate Data Model (STANAG 5523 / AdatP-32). It will evolve into the NATO JC3IEDM.
- Implementation of the MIP specification is a NATO Force Goal (EL2802).
- NATO Policy on MIP calls for close co-ordination and re-use of the MIP specification within NATO.
- Bi-SC Automated Information System will use the MIP solution in its Land Functional Services (LandFS) to interface to national CCIS, either in HRF/LRF, CJTF or other crisis response operation or exercise9.
- NATO Standardisation Agreement SO 01-11 calls for the implementation of MIP specifications.
- The MIP specification is well regarded in the NC3A. It is the core capability of the NC3A Integrated Data Environment prototype, a capability to integrate legacy systems.
- The MIP specification is included in the NATO C3 Technical Architecture.
- The NATO Military Criteria for High Readiness Forces (Land) Headquarters requires the use of an ATCCIS10 compliant land information system.
- NATO Response Force (NRF) requirements call for the use of a MIP compliant interoperability solution.
- Many national C2 information systems implement MIP specifications.

1.6 Purpose

The MIP technical functions described in this document shall meet the requirements as stated in the document “MIP System Requirement Specification” (SRS) and ultimately the requirements stated in “MIP Tactical C2IS Interoperability Requirements” (MTIR).

1.7 Scope

[9] Bi-SC transition Management Board Report to Bi-SC CIS Board, on 25th September, 2002

[10] MIP is the custodian of the ATCCIS specifications.

MIP shall define all aspects of technical, procedural and operational interoperability between the participating allied partners. The MTIDP describes and specifies the functions which are necessary to secure the technical interoperability between the C2ISs. In Figure 1-1 these technical functions are displayed as the grey shaded modules, representing the scope of this document.

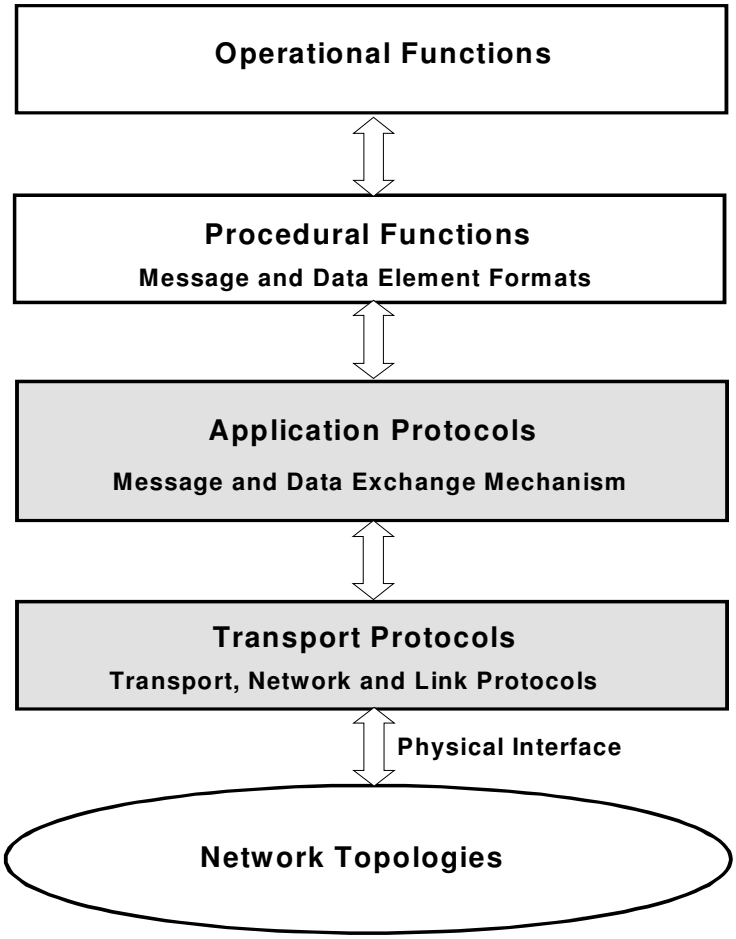


Figure 1-1. Scope of the MTIDP

Figure 1-1 shows an overview of the tasks and functions which all participating systems shall implement in order to gain interoperability. The ”Operational” and ”Procedural Functions” are not part of the MTIDP and are specified in separate documents.

The ”Application Protocols” adapt the C2IS applications to the communication system. They relieve the operator of most of the communication tasks by handling the communication processes automatically. The application protocols in MIP shall meet the requirements of

message and data exchange via reliable trunk networks and also less reliable radio networks. The principal tasks of the MIP application protocols are to provide a Message Exchange Mechanism (MEM) and a Data Exchange Mechanism (DEM).

The ”Transport Protocols” provide the transport services for the application protocols, that is, they take care of the reliable transmission of the data from the sender (originator) to the addressee (recipient). These protocols are divided in several layers having different tasks. The transport layer may segment larger messages, takes care of the flow control and end-to-end confirmation. The network layer is responsible for routing the data through local and external networks, that is, to lead their way from the sender through the networks to the recipient. The link layer secures the correct transmission between two data communication entities. Finally, the physical layer describes the physical connection to the actual transmission media, e.g. the specification of a plug, cables and voltage levels.

Since the different command levels from battalion to corps use different wide area (WAN) networks including combat net radios (CNRs), satellites, dial trunk systems via wire and wide-band microwave links, different network topologies may be used in order to optimize the battlefield communication. The capacities of the presently available common NATO networks do not satisfy the communication requirements of MIP, hence the MTIDP shall include feasible concepts for the integration of the different national networks into a common MIP network topology.

1.8 Definitions, Acronyms and Abbreviations

Definitions, acronyms and abbreviations can be found in the glossary at ANNEX Y – GLOSSARY.

1.9 References

Source references can be found at ANNEX Z - REFERENCES.

2 MULTILATERAL INTERFACE DESIGN

2.1 MIP Generic Architecture

The MIP concept involves each nation deploying and providing an interface mechanism, referred to as the MIP Common Interface (MCI). The MCIs will form a gateway between the national C2ISs as well as between the different national fielded communication networks.

The implementation of the MCI functions is national concern. It may be part of a national C2IS or built as a separate gateway. Either way it shall provide the identical physical and logical interface services for the MIP partners as defined in this document.

Figure 2-1 shows the generic network architecture of MIP. The actual location of the MCI as well as the type of network may differ and depends on the specific network topology chosen. This choice depends on the availability of a certain network and the actual battlefield situation. Section 2.3 describes several examples of possible MIP network configurations, using the identical MIP Common Interface functions in each case.

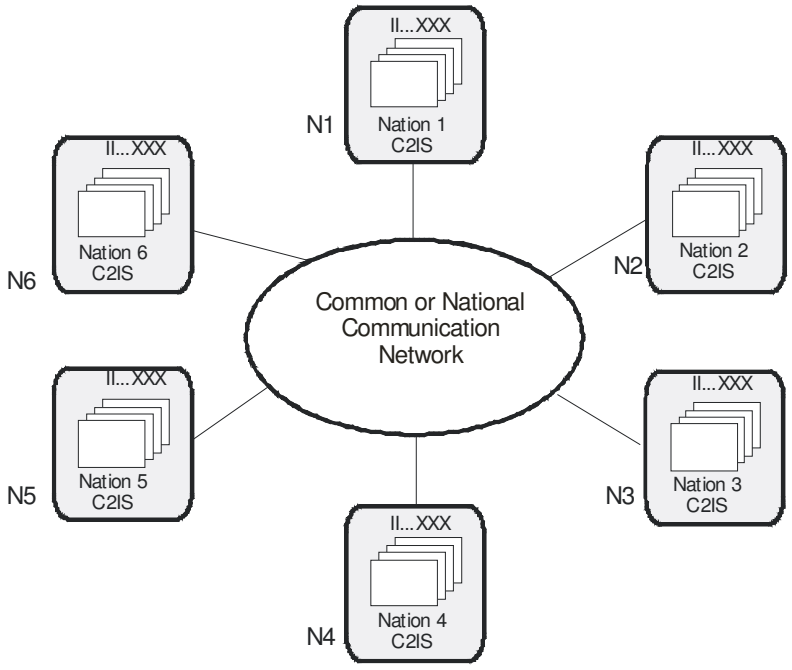


Figure 2-1. MIP Generic Archiceture

2.2 Architecture of the MIP Common Interface

To facilitate the use of networks for all participating nations, each network and/or C2IS shall provide a commonly used standard physical connection, the Ethernet LAN. Those LANs are already contained in the C2ISs of most nations, hence being the preferred connection of all MCIs.

The LAN shall be used for the interconnection of two or more MCIs. The MCI shall provide common communication functions for message and data exchange with the allied partners. It is national responsibility to convert this common protocol stack, if necessary, into a national protocol stack suitable for the respective national networks, e.g. for:

- Data exchange via LAN, if the C2ISs of 2 or more nations are co-sited
- Data exchange via reliable WAN networks, e.g. dial trunk systems
- Data exchange via unreliable WAN networks with low throughput, e.g. HF or VHF radio
- Message exchange via LAN, in case the different national C2ISs are co-sited
- Message exchange via reliable WAN networks, e.g. trunk systems
- Message exchange via unreliable WAN networks with low throughput, e.g. HF or VHF

Figure 2-2 displays the basic functions of a MCI. It shows that the common part is only the physical LAN. The MIP protocol stack provides the communication services for the procedural levels of message and data exchange, which are described in other documents.

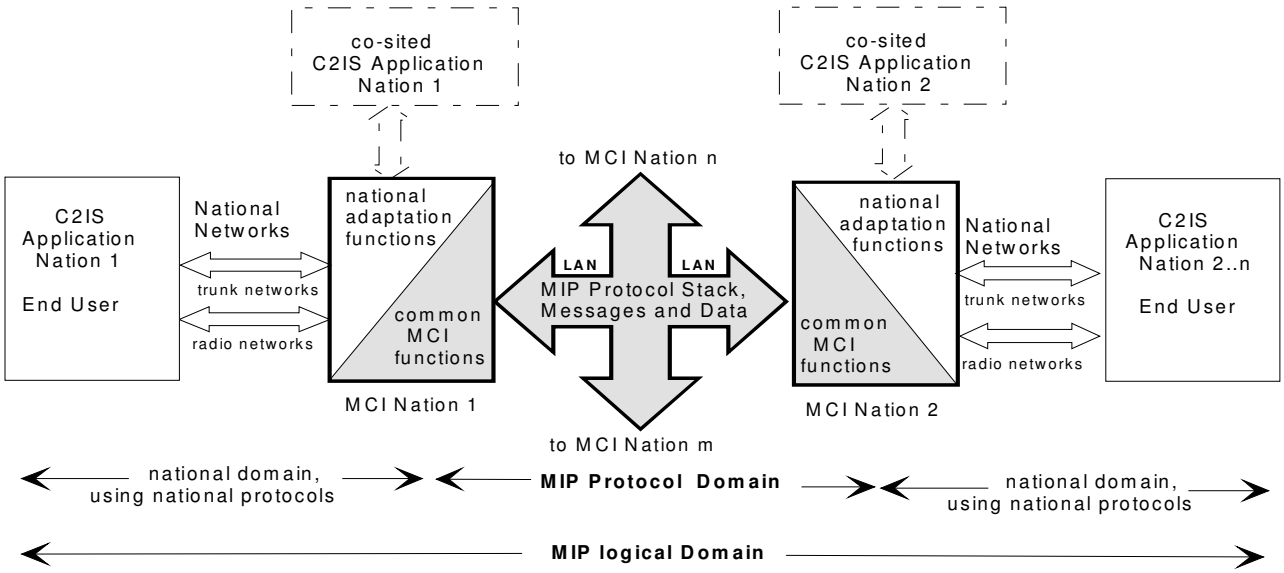


Figure 2-2. MIP Common Interface (MCI)

The implementation of the actual MCI functions, e.g. mapping of the communication protocols, message formats and data element structures as indicated in Figure 2-2 as ”National Adaptation Functions”, is national concern. Some nations may implement only a communication gateway containing protocol conversions, other MCIs may contain the full C2IS capability if message and data element formats have to be converted within the MCI. In some cases, the Command Post is co-sited at the MCI, not using any WAN networks, as indicated in Figure 2-2 by the dotted function blocks. Whatever implementation or network topology, the MCI shall provide identical protocols, message and data element formats for the other nations’ MCIs via the common LAN.

2.3 MIP Network Topologies

Based on the MIP generic architecture (Figure 2-1) and the MCI functionality (Figure 2-2), different network topologies may be established. Figure 2-3 shows the basic MIP topology, the so-called Centralized Configuration. The MIP Common Interfaces of each nation are positioned at a central location and are connected via a LAN. The LAN contains the protocol functions as indicated in Figure 2-2. To the other side, the MCIs are connected with their corresponding C2ISs via national networks.

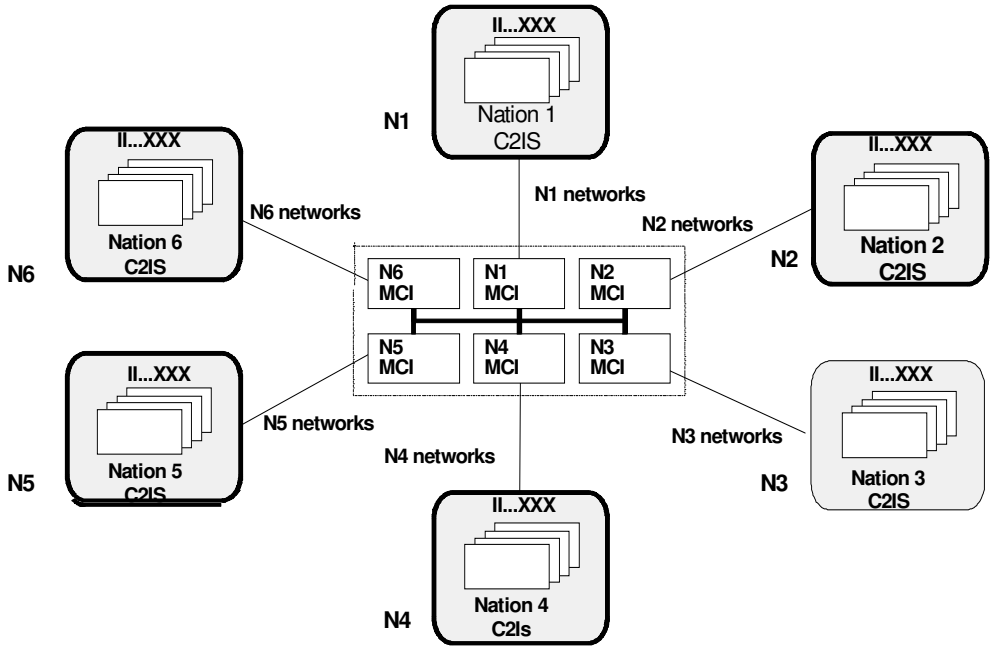


Figure 2-3. Centralized Configuration

The specification of the national network is not relevant for the other nations' C2IS. It may be any radio, wire, microwave, satellite or any other trunk network which is available in a certain battlefield situation. Each nation, however, shall prove the feasibility and secure operation of its MCI functions using its trunk and radio networks. It may be assumed that mostly VHF and HF radios (unreliable and low-throughput networks) are used at battalion level, whereas trunk systems (reliable networks) are available at the levels brigade to corps. Most likely, radios are also used for communication between brigade and battalion.

Another topology example is the Decentralised Configuration. It uses the identical MCIs as the above Centralised Configuration, but co-sited at the C2ISs. As displayed in Figure 2-4, Nation 1 (N1) provides its national network to the other nations (N2..N6). The adaptation to this network is performed by the MCIs, all nations use the WAN of Nation 1.

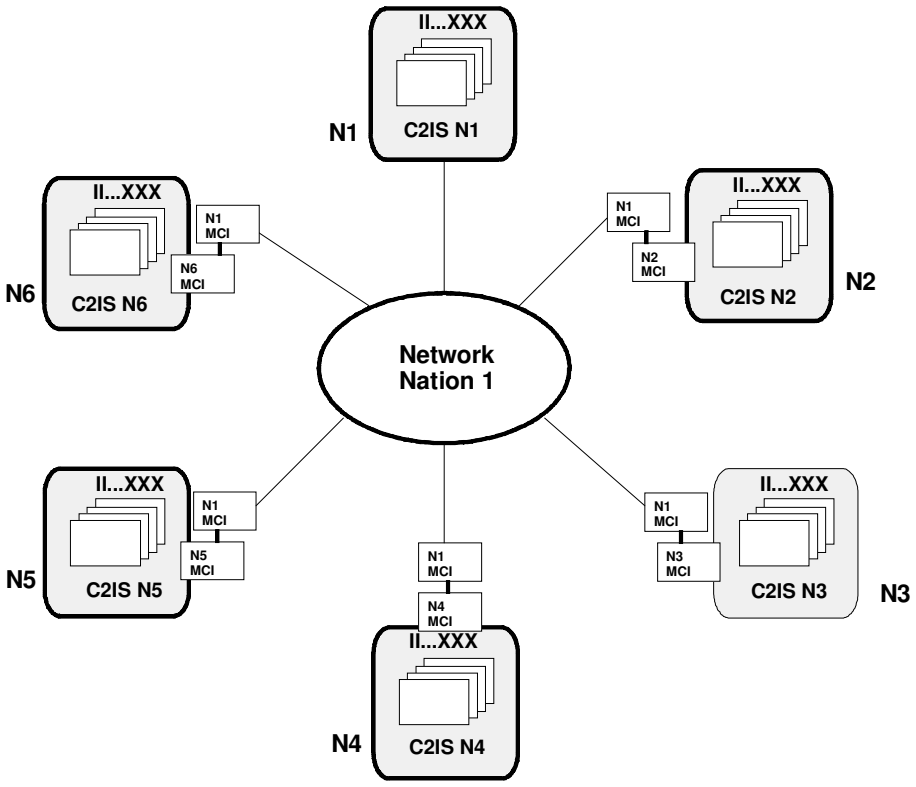


Figure 2-4. Decentralized Configuration

Figure 2-5 shows an example of a Hybrid Configuration, combining the topologies of the two previously described centralized and decentralised configurations as well as showing some additional network features. It depicts the possibilities of meshing the different national networks by using the MCIs in different configurations.

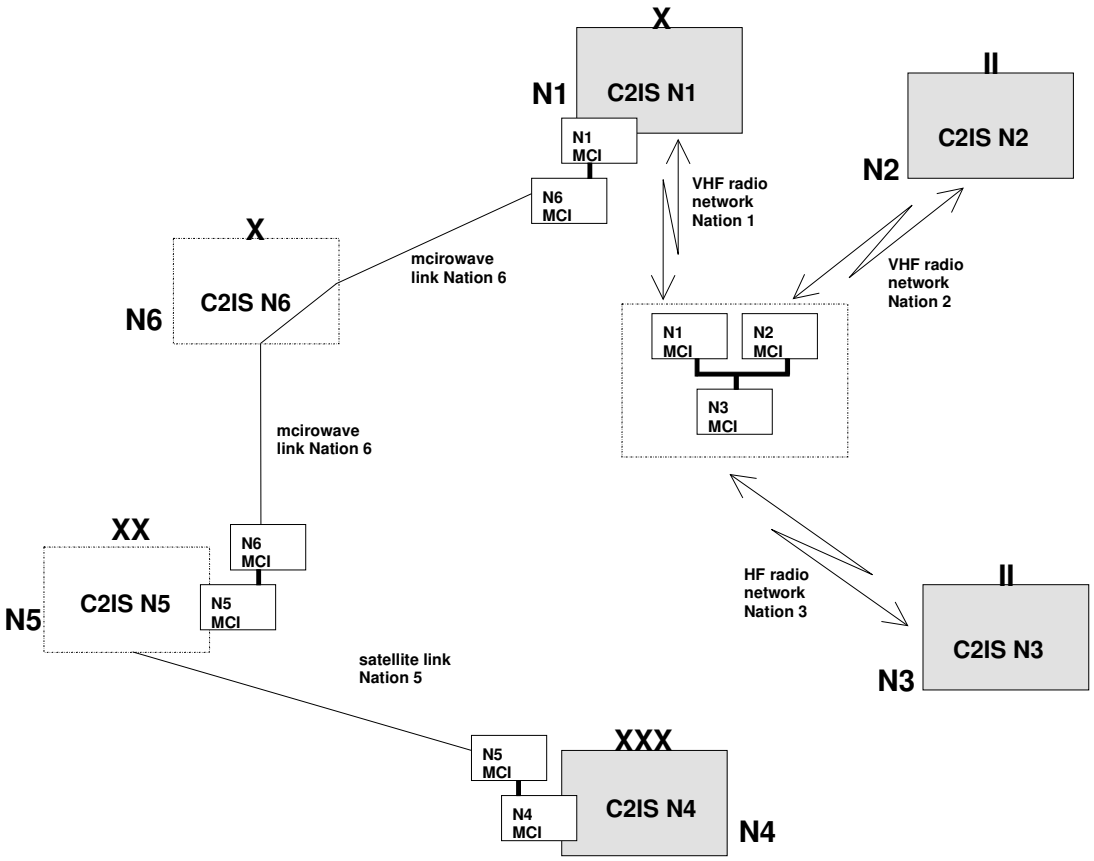


Figure 2-5. Example of the Hybrid Configuration

All three topologies use the identical MCI functions, only the address configuration changes.

Figure 2-6 depicts a variation of the decentralised configuration with the MCIs non co-located that implies a framework nation (or it can be used if multinational network is interoperable). This deployment could save assets (MCI) of the framework nation compared to the decentralized and co-located option, but the use of liaison teams will prevail in any case.

These are possible deployment options available to the nations and they make no assumptions about the relevant national security issues that could affect the deployment options of the MIP solution.

Nations are only required to prove the functionality of their MCI within the Centralised Configuration as shown in Figure 2-3. Other configurations may be used according to the availability of C2IS and network components and battlefield situation.

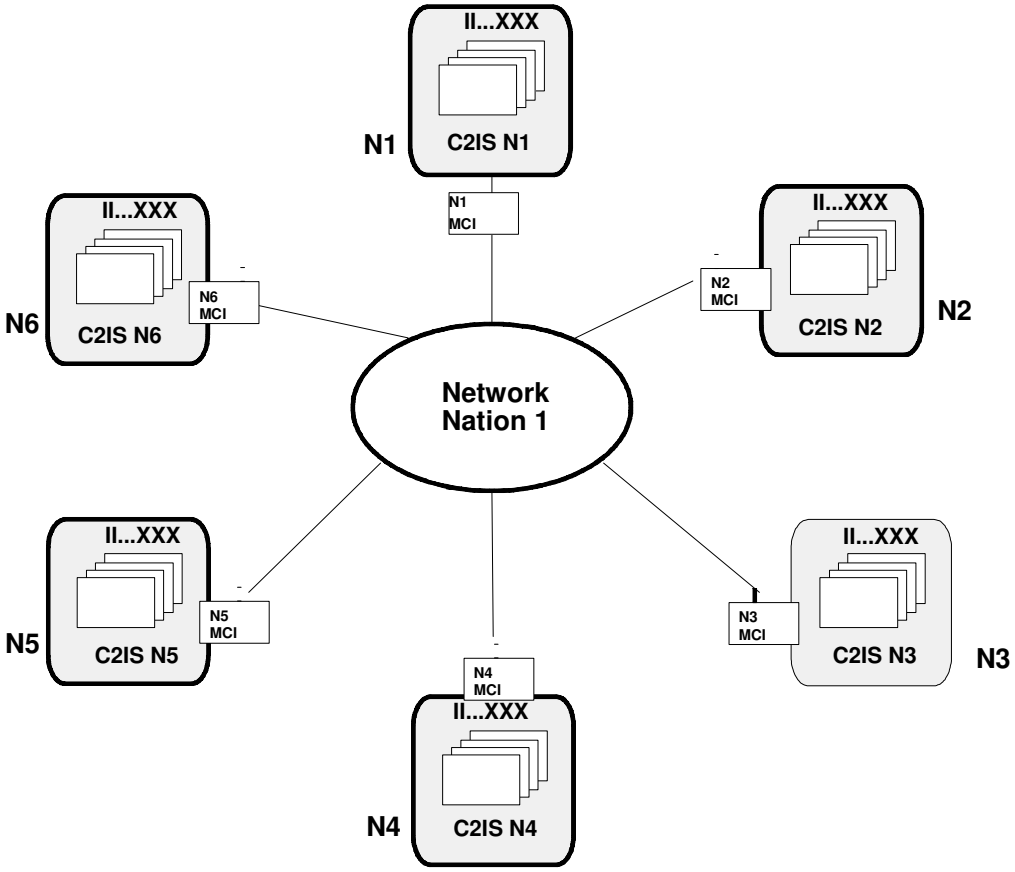


Figure 2-6. Example of the Decentralised non Co-Located Configuration