NATO STANDARD

AEP-4754

NATO GENERIC VEHICLE ARCHITECTURE (NGVA) FOR LAND SYSTEMS

VOLUME IV: CREW TERMINAL SOFTWARE ARCHITECTURE

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NATO LETTER OF PROMULGATION

22 February 2018

1. The enclosed Allied Engineering Publication AEP-4754, Volume IV, Edition A, Version 1 NATO GENERIC VEHICLE ARCHITECTURE (NGVA) FOR LAND SYSTEMS VOLUME IV: CREW TERMINAL SOFTWARE INFRASTRUCTURE, which has been approved by the nations in the NATO Army Armaments Group, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 4754.

2. AEP-4754, Volume IV, Edition A, Version 1 is effective upon receipt.

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4. This publication shall be handled in accordance with C-M(2002)60.

for

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Major General, LTUAF
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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
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CHAPTER 1 INTRODUCTION

1.1. Purpose

The aim of the NGVA Standard AEP-4754 Volumes I through VII is to enable the member nations to realize the benefits of an open architecture approach to Land vehicle platform design and integration, especially in regard to the vehicle platform electronic data and power infrastructure and the associated safety and verification & validation process.

1.2. Application of the NGVA Standard

The NGVA Standard is to be applied to all future land vehicle platforms and vehicle platform sub-system, as well as current vehicle platform refurbishment and upgrade programmes.

This NGVA Standard is applicable to land vehicle platforms, ranging from simple to complex implementations. The requirements for these implementations are determined by the functionality required of the vehicle platform as a whole system including all sub-systems, and not the automotive or power elements alone. The requirements address equipment to be fitted as part of the initial operating capability and equipment likely to be fitted throughout the life of the vehicle platform. These requirements are expressed in the national system requirements documents and/or the sub-system requirements documents for the individual vehicle platforms concerned.

1.3. Agreement

Ratifying nations agree that the NGVA Standard is to be applied to all future land vehicle platforms and vehicle platform sub-systems, as well as current vehicle platform refurbishment and upgrade programmes. Nations may propose changes at any time to the NATO Standardization Office (NSO).

Germany will act as custodian to maintain Configuration Management (CM) and change management of this Standard and its associated AEP Volumes.

Ratifying nations have agreed that national orders, manuals and instructions implementing this Standard will include a reference to the AEP-4754 Volumes I through VII for purposes of identification.

The NGVA Standard and its associated Volumes I through VII shall be considered as the foundation standard for vehicle sub-system integration, and should any conflict arise between this and other extant NATO documentation, this document shall take precedence.

Deviations from the NGVA Standard shall be agreed by the relevant national procurement office.

1.4. Ratification, implementation, and reservations

Ratification, implementation and reservation details are available on request or through the NATO Standardization Office (NSO) (internet: http://nso.nato.int).

1.5. Feedback

Any comments concerning this publication should be directed to: NATO/NSO – Bvd Leopold III - 1110 Brussels - Belgium.

Proposals for changes and improvements of the NGVA Standard AEP-4754 volumes I through VII shall be sent to the NSO and then forwarded to the custodian who will collect them and will propose new editions of the NGVA Standard AEP-4754 Volumes I through VII.

The NGVA Standard Point-of-Contact as assigned by the NGVA Standard Custodian is BAAINBw K1.2, Ferdinand-Sauerbruch-Str.1, D-56073 Koblenz, Germany.

CHAPTER 2 DEVELOPMENT OF NGVA STANDARD

The NATO Generic Vehicle Architecture (NGVA) Standard was developed under the auspices of the Military Vehicle Association (MILVA).

MILVA is an association of government agencies and industries promoting Vehicle Electronics (Vetronics) in the military environment. MILVA provides an open forum to its members and publishes guidelines and standards on Vetronics issues. MILVA works in close co-operation with NATO through the Land Capability Group on Land Engagement of the NATO Army Armament Group (NAAG).

2.1. NGVA Standard Structure

Figure 1 below illustrates the Standard structure, the Volumes relationships and technical areas covered under each Volume.

NGVA Standard AEP-4754	
Volume I	NGVA Architecture Approach (Describes the NATO Generic Vehicle Architecture (NGVA) concept)
Volume II:	NGVA Power Infrastructure (Defines the design constraints on power interfaces which form the NGVA Power Infrastructure)
Volume III:	NGVA Data Infrastructure (Defines the design constraints on the electronic interfaces that form the NGVA Data Infrastructure)
Volume IV:	NGVA Crew Terminal Software Architecture (Defines the design guidelines and constraints for standardized “Crew Terminal Software Applications”)
Volume V:	NGVA Data Model (Describes the NATO GVA Data Model (NGVA DM), the Model Driven Architecture (MDA) approach used to produce the NGVA DM, the toolset required to produce and manage the configuration control of the NGVA DM and finally the applicability of the NGVA DM to Data Distribution Service (DDS) middleware installed on a GVA compliant platform.)
Volume VI:	NGVA Safety (Outlines the generic procedures to incorporate system safety related planning, development, implementation, commissioning and activities in systems engineering)

Volume VII:	NGVA Verification and Validation (Provides guidance for the verification and validation of NGVA systems regarding their conformity to the AEPs associated with this STANAG)

Figure 1: NGVA Standard AEP-4754

2.2. General Notes

2.2.1. Scope

NGVA is the approach taken by NATO and related industry to standardize the interfaces and protocols for military vehicle systems integration. The Vehicle Architecture (including data and power architectures) is considered as the fundamental enabler that can provide new capabilities on military platforms so as to improve overall effectiveness (including cost) and efficiency within the whole vehicle life cycle. The NGVA Standard does not include standard automotive electronics and power related information.

2.2.2. Warning

National governments, like their contractors, are subject to laws of their respective countries regarding health and safety. Many NATO STANAGs and Standards set out processes and procedures that could be hazardous to health if adequate precautions are not taken. Adherence to those processes and procedures in no way absolves users from complying with their national legal requirements.

2.3. Normative References

The documents and publications shown in Table 1 below are referred to in the text of this AEP Volume. Documents and publications are grouped and listed in alpha-numeric order:

1. DDS Interoperability Wire Protocol Specification v2.1	DDS Interoperability Wire Protocol specification (DDS-RTPS) (http://www.omg.org/cgi-bin/doc?formal/10-11-01.pdf)
2. EN ISO 9241	Part 110: Ergonomics of Human-System Interaction - Dialogue Principles Part 171: “Ergonomics of Human-System Interaction – Guidance on Software Accessibility”
3. IEEE 802.3	Ethernet Standards Collection
4. OMG Data Distribution Service (DDS) v1.2	Data Distribution Service for Real-Time Systems ('DDS) (http://www.omg.org/cgi-bin/doc?formal/07-01-01)
5. STANAG 4697/AEP-79	Platform Level Extended Video Standard (PLEVID)

Table 1: Normative References

Reference in Standard AEP-4754 and its Volumes to any normative references refers to, in any Invitation to Tender (ITT) or contract, the edition and all amendments current at the date of such tender or contract, unless a specific edition is indicated. For some standards, the most recent editions shall always apply due to safety and regulatory requirements.

In consideration of the above and as best practice, those setting the requirements shall be fully aware of the issue, amendment status and application of all normative references, particularly when forming part of an ITT or contract.

2.4. Conventions

For the purposes of all AEP Volumes all requirements are specifically detailed in tables with each requirement classified as in the paragraph 2.5. Where an AEP Volume contains no specific requirement tables they should serve as implementation guidance until technical standardization requirements are developed and included.

2.5. Requirements Classifications

The following classifications are to be used for all NGVA related requirements.

2.5.1. Compulsory Requirement (CR)

The requirement needs to be implemented in order to conform to Standard AEP-4754 and to gain certification. Compulsory requirements are listed in the Requirements Tables inside the AEPs and marked as “CR”.

2.5.2. Optional Enhancement (OE)

Optional Enhancements do not need to be implemented in order to conform to Standard AEP-4754. However, if such a capability is present, it needs to be implemented according to the stated specification in order to be compliant. Optional Enhancements are listed in the Requirements Tables inside the AEPs and marked as “OE”.

2.6. Abbreviations

Abbreviations referred to in this AEP Volume are given in Annex A.

2.7. Terms and Definitions

2.7.1. NGVA Definitions

1. **Base Vehicle**: The basic vehicle structure and those systems needed to enable it to perform its automotive functions and mobility. Where fitted it also includes those systems needed to control turrets and other physical elements e.g. a mine plough.
2. **Base Vehicle Sub-System**: A system that forms part of the base vehicle
3. **Electronic Architecture**: The combination of the electronic based sub-systems and electronic infrastructure that supports the vehicle crew to undertake their operational tasks
4. **NATO Generic Vehicle Architecture (NGVA):** The term ‘NATO Generic Vehicle Architecture’ refers to the open, modular and scalable architectural approach applied to the design of vehicle platforms.

5. **Hard Switching:** The ability to control or operate a sub-system using physically based means.
6. **Measure of Effectiveness:** A description of how effective a solution candidate is for a particular assessment criterion.
7. **Measure of Performance:** A statement that describes the assessment criterion or criteria needed to satisfy a given requirement.
8. **Modular**: A modular architecture is designed in such a way as to allow the replacement or addition of sub-systems and upgrades as required without any undesirable emerging properties.
9. **NGVA Compliant:** NGVA Compliance applies to the whole vehicle platform and means that any sub-system existing on the platform complies with the requirements defined in STANAG 4754 and associated AEPs.
10. **NGVA Electronic Infrastructure:** The physical cables and connectors that provide means of distributing data around a base vehicle. It also includes any enabling logical components and functions e.g. Core platform management software, interface software, transport protocols and message definitions.
11. **NGVA Power Infrastructure:** The physical cables, connectors and other components that provide the means of distributing and controlling electrical power around a vehicle platform.
12. **NGVA Ready**: NGVA Ready applies at a sub-system level and means that sub-systems and components have been developed to a level where they can be efficiently integrated within a "NGVA Compliant" whole vehicle Electronics. This would mean passing an incremental process with two sequentially-related Compatibility levels:
    a. **Connectivity Compatibility**: Ensures that the (sub-) system can be physically integrated into the NGVA architecture without any negative impacts to existing NGVA components. Physical power and network interfaces comply with the requirements of Power and Data Infrastructure AEPs.
    b. **Communication Compatibility**: Connectivity Readiness and data interfaces (DDS/Video) with associated NGVA Data Model implementation that comply with the requirements of Data Model and Data Infrastructure AEPs.
13. **Operator:** Any person required to interface and control vehicle platform sub-systems.
14. **Power Management:** The means of prioritizing and controlling the electrical power loads throughout the vehicle platform.
15. **Scalable**: The trait of a system in being able to scale in order to handle increased loads of work.
16. **Soft Switching:** The ability to control or operate a sub-system using software functionality.
17. **Sub-System:** Separable elements or collections of equipment or software added to a base vehicle that provides operationally required capabilities over and above those delivered by the base vehicle.
18. **System:** A combination, with defined boundaries, of elements that are used together in a defined operating environment to perform a given task or achieve a

specific purpose. The elements may include personnel, procedures, materials, tools, products, facilities, services and/or data as appropriate.

19. **Vehicle Crew:** All personnel located in the vehicle platform with defined roles needed to fulfil the necessary operational functions.
20. **Vehicle Platform**: The vehicle and all its integrated sub-systems.
21. **Vehicle Users:** The individuals and groups of people who interact locally to operate, support, sustain, maintain or otherwise interface directly with the Vehicle Platform and its sub-systems. It includes Service personnel, Reserve personnel, and Civilian employees, and may include personnel under other service supply contracts.

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CHAPTER 3 OVERVIEW

The NGVA Crew Terminal (CT) Software Architecture defines design guidelines and constraints for standardized “Crew Terminal Software Applications”. This is done with the help of the following building blocks:

- CT Software Design Principles (Architecture & Ergonomics)
- CT Software Execution Environment
- CT DDS Backbone for Inter-process Communication
- Human Input Devices (HID) & CT Output Devices
- CT Power Modes & Light Modes

Currently, the “Look & Feel” and human factors are not within the scope of standardization, since this is considered to be nation-specific. The current version of this AEP is provided as guidance and any reference to requirements or requirement classification should be interpreted as recommendations.

3.1. Scope

A NGVA Crew Terminal (CT) Software Architecture standard should support the principles of open modular architectures embodied in the goals of NGVA, facilitating the flexible composition of CT systems built of software modules that can be supplied and maintained through open third party competition throughout the life of the system. In particular, for CT deployments, the architecture should be supportive of the need to compose CT systems into a range of hardware & software topologies. These can vary from a single comprehensive CT facility integrating the total CT functionality of an entire vehicle system through to a distributed system of stand-alone CT devices spread throughout the vehicle and then combinations between those two extremes.

The specific need for a CT Software-Architecture AEP arises from the need to apply those primary NGVA principles to software architectures. The NGVA needs to facilitate re-use and portability of CT application software modules across all NGVA platforms so that:

1. The same software application is not re-written for every NGVA CT deployment from any supplier in different types of vehicles
2. CT software modules can be easily added/removed/changed as vehicle equipment and CT devices are added, removed and changed
3. CT software can be maintained and enhanced throughout the lifetime of the architecture through open third party competition

To realize a Crew Terminal Software Architecture that facilitates these goals necessitates that a number of software interfaces are standardized. The main purpose of these software interfaces is to de-couple the software implementations of specific CT software modules from each other and introduce modularity and interoperability. Depending on where the boundaries of modularity are placed, these elements may include:

- Application Inter-Process Communication (IPC)
- Transport, e.g. Shared Memory with DDS
- Platform specific services, e.g. Graphics APIs
- I/O Services, e.g. APIs to device drivers
- OS, e.g. APIs such as POSIX
- Language run-time APIs e.g. the C Standard Library
- Framework APIs, e.g. common HMI facilities for applications to use
- Machine processor, i.e. target processor technology
- Machine architecture, i.e. target computer environment facilities and configuration

Ideally, all the necessary interfaces would be defined in NGVA and it would be possible to add, remove and combine the same modules of executable binary code across all NGVA Crew Terminal systems, with all their different topologies and all their different machine technologies and machine architectures. However, to achieve this in practice it would require significant time and resource in research and development and the return may not justify that investment.

The aim of this current issue of the NGVA Crew Terminal Software Architecture AEP is to address only the definition of a standard Inter-Process Communication (IPC) interface and the nature of its deployment in alignment with Crew Terminal hardware, so that NGVA CT software modules can be made portable and re-usable in the form of source code that is then compiled, linked and deployed to match the OS and machine technology/architecture of each specific target platform. This may of course require additional platform specific source code to address machine technology specifics that are not adequately abstracted by the OS.

Nations may of course achieve greater portability within their own jurisdictions by standardizing some elements of the execution environment listed or by identifying an abstraction technology, similar to Future Airborne Capability Environment (FACE) or European Component Oriented Architecture (ECOA), to provide a nation specific application hosting environment.

Future issues of this NGVA AEP should aim gradually to address the standardization of those interfaces to achieve an appropriate level of portability with an appropriate level of agility. Fitting somewhere on the agility spectrum between bespoke software builds generated for each platform deployed in planned factory upgrade programmes and the other extreme of ad-hoc run-time updates of common executables deployed in the field.

CHAPTER 4 CREW TERMINAL SOFTWARE ARCHITECTURE

The “Crew Terminal Software Architecture” defines the following building blocks for NGVA-conformant Crew Terminal Software Applications. According to the type of requirements (CR, OE) the system designer/integrator has to decide how to take them into account.

1. CT Software Design Principles (Architecture & Ergonomics)
2. CT Software Execution Environment
3. CT DDS Backbone for Inter-process Communication
4. Human Input Devices (HID)
5. CT Output Devices
6. CT Power Modes
7. CT Light Modes

4.1. Crew Terminal Software Design Principles

4.1.1. Architectural Design Principle

The general NGVA design principle of a data centric architecture and decoupled modules shall be taken into account for NGVA-conformant Crew Terminal Software Systems. Software interfaces shall be defined with the NGVA Data Model (Volume V) and shall use the Data Distribution Service as Data Exchange Mechanism (Volume III), or PLEVID (STANAG 4697), if applicable.

4.1.2. Ergonomic Design Principles

EN ISO 9241-110 (“Ergonomics of Human-System Interaction - Dialogue Principles”) standardizes the ergonomic principles which apply to the design of dialogues between humans and information systems:

1. Suitability for the task
    - Effective and efficient task processing
2. Suitability for learning
    - Easy to learn
3. Conformity with user expectations
    - Provide consistency throughout the whole Human Machine Interface (HMI) and respect accepted conventions
4. Self-descriptiveness
    - Understandable
5. Controllability
    - Easy, flexible and intuitive
6. Error tolerance
    - Undo inputs
7. Suitability for individualization
    - In military context a dynamic individualization is often not desired. However, it could be helpful to support different software variants and different languages

EN ISO 9241-171 (“Ergonomics of Human-System Interaction – Guidance on Software Accessibility”) addresses software considerations for accessibility that complements general design for usability.

These general ergonomic design principles should apply for NGVA Crew Terminal Software.

Specifications of ergonomic design principles and style guides beyond this general scope are an issue for national standards and guidelines, as e.g. GBR Def Stan 23-009 Part 2 (HMI), GBR Def Stan 00-250 (Human Factors) or DEU HMI Style Guide (BAAINBw R&D Studies “HMI-mMS”, and “PAINTER A+M”.

The system designer/integrator has to assure that the above listed guidelines are fulfilled with concrete specifications or national standards

4.2. Crew Terminal Software Execution Environment

A standard machine interface (e.g. in FACE, via POSIX) is not defined, c.f. CHAPTER 3, primarily because the exact definition of CT Software Execution Environment is currently a nation-specific issue, although the aspiration exists to bring commonality to this family of interfaces to achieve greater software and device portability across the NGVA community. This Volume should consider this issue for future enhancements.

4.3. Crew Terminal DDS Backbone for Inter-process Communication

4.3.1. Crew Terminal DDS Backbone – Logical View

In accordance with the NGVA Data Infrastructure and with the basic design principle of “Loose Coupling” (see also Section 4.1.1) a “DDS Backbone” shall be used for inter-process communication within a NGVA Crew Terminal system. This architectural principle is depicted in Figure 1 with the help of a logical view. A logical component CT-Core communicates with the “Human Input Device (HID) Drivers” and the logical components “Graphical User Interface (GUI) Apps”. The communication is established via the same technology as is used for communication with NGVA mission subsystems i.e. Data Distribution Service (DDS), with the only difference being the Crew Terminal internal communication shall be decoupled from other Crew Terminals, e.g. per DDS over shared memory instead of Ethernet / UDP.

The role of the CT Core is a CT-specific and CT-local task & window management, i.e. the Core is responsible to

- start and stop GUI Apps and HID Driver services and monitor them
- define a role-specific set of mission task oriented screens
- control the visibility and geometry of GUI Apps on the defined screens according to HID events and a predefined basic task processing scheme

The role of GUI Apps is to implement the detailed task processing scheme, display the content to the user, receive the user input and interface the mission subsystems.

GUI Apps need to implement the IPC interface for communication with the CT Core and the HID Driver Services. The Apps could be created by the mission subsystem manufacturer and could be provided upon subsystem delivery.

The role of HID Driver Services is to translate different HID interfaces into one common IPC interface. C.f. Section 4.4 for possible input devices and their input information.

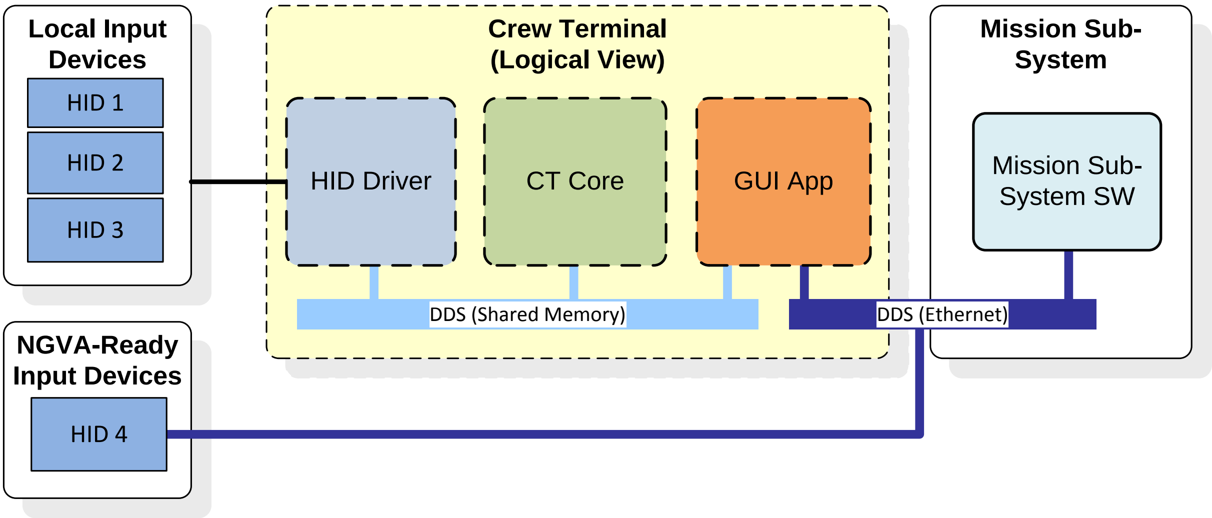

Figure 1: Crew Terminal DDS Backbone – Logical View

Figure 1 also shows two different principles for interconnection with Human Input Devices (HID). Input devices can be attached via peripheral interfaces of the Crew Terminal (e.g. USB), or NGVA-ready input devices are attached via Ethernet. In the first case, a HID-Driver is required to translate the native HID communication to “HID” data structures of the CT Data Model. In the second case, the NGVA-ready device directly communicates via DDS by using the “HID” events.

4.3.2. Crew Terminal Software Deployment Examples

Figure 2 and Figure 3 show different implementation examples of the CT DDS Backbone. Figure 2 depicts separated processes for CT Core and GUI App and Figure 3 depicts an implementation with a process that combines CT Core and GUI App. The second example is only a valid implementation if no further interoperable applications deployed on the Crew Terminal. Therefore, this configuration is not considered as main implementation example.

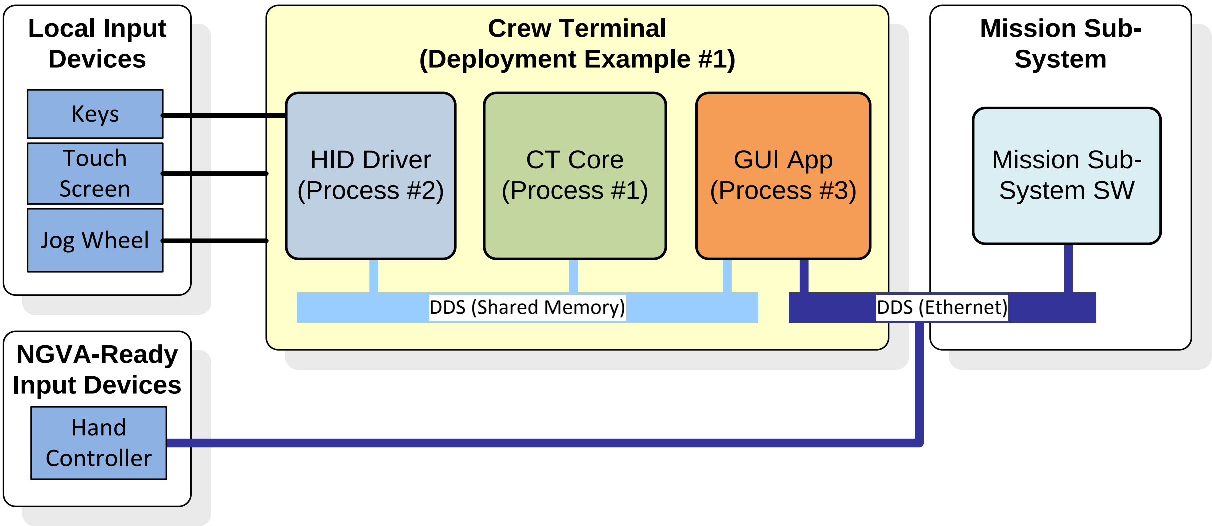

Figure 2: CT Software Deployment Example #1

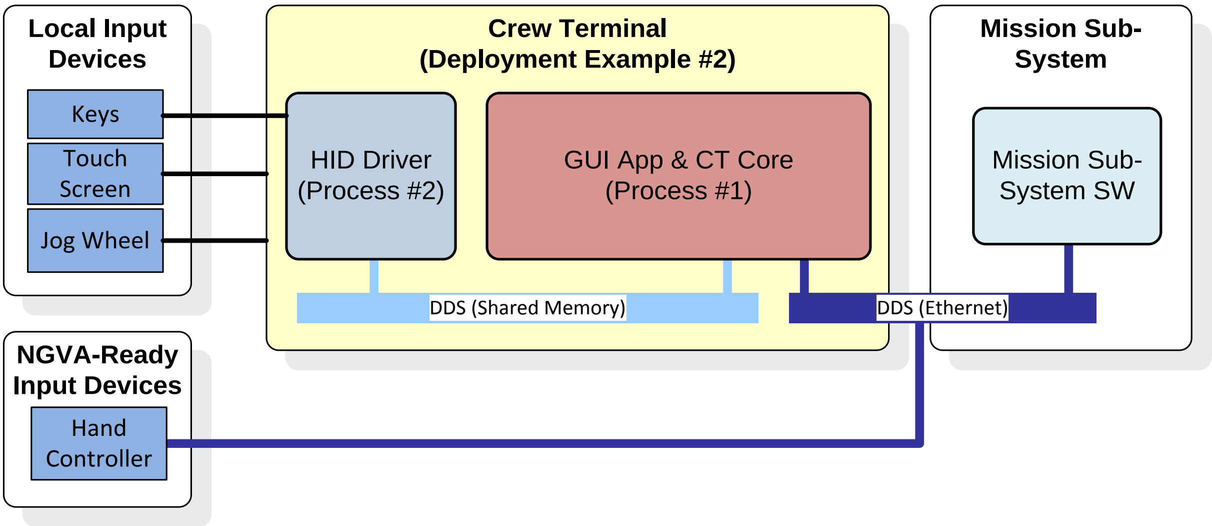

Figure 3: CT Software Deployment Example #2

4.4. Human Input Devices (HID)

NGVA Crew Terminals may use, but are not limited to the following Human Input Devices:

- Buttons (hard or soft keys with printed or on-screen label)
- Hand/Thumb Controller (joystick, two hand handle, gamepad)
- Pedals (loud and brake pedal, left and right pedal)
- Mouse (touchpad, trackball, laser mouse)
- Touch Screen (single or multi-touch)
- Switches (key-switch, jogwheel, turning knob, gearstick)
- Keyboard (hardware or on-screen)
- Microphones
- Wearable HIDs like Glasses, Helmets with Head-up Displays
- Further (future) input devices

The number, type, size and location of the CT Input Devices are highly dependent on the vehicle type. This is a system specific aspect. Except of native mouse, touchscreen or keyboard input, all HID must communicate with appropriate data structures as defined in the NGVA Data Model. If no applicable data structure is available the NGVA Data Model has to be extended.

4.5. Crew Terminal Output Devices

NGVA CT Software may use, but is not limited to the following output devices:

- Display
- Augmented Reality Applications
- Visual Feedback Devices
- Audible Feedback Devices
- Tactile Feedback Devices
- Further (future) Output Devices

4.5.1. Display and Augmented Reality Applications

The realization of GUI apps needs to consider different display resolutions. It is recommended that all content, which shall be depicted on the CT display, is scalable and can be resized for optimal use of the system specific resolution.
GUI apps should integrate concepts of Augmented Reality for enhanced Situational Awareness.

4.5.2. Visual/Audible/Tactile Feedback Devices and other/future Devices

In combat situations it is important to provide feedback to the user as quick as possible. Available and mature visual, audible or tactical feedback devices should be used for that purpose. These and any other features must be controlled with appropriate data structures as defined in the NGVA Data Model. If no applicable data structure is available the NGVA Data Model has to be extended.

4.6. Crew Terminal Light Modes

The brightness of the display should be adjustable by software because of changing environmental circumstances in vehicles. The number of CT Light Modes and the corresponding brightness levels have to be chosen carefully according to the vehicle use case. This is a system specific aspect.

Specific safety critical situations require that all light emitting sources within the vehicle can be disabled. Therefore the Crew Terminal has to evaluate the blackout signal which is provided by the power connector as defined in the NGVA Power Infrastructure Volume II.

4.7. Crew Terminal Power Modes

The Crew Terminal has to manage its own power consumption as well as the consumption of all attached peripheral devices.

4.7.1. Power-up / Shutdown Behavior

The Crew Terminal may need a specific shutdown procedure for reliable shutdown without data-loss so it shall not be switched off immediately (e.g. RAM or HDD failure). Therefore the CT has to evaluate the ignition signal which is provided by the power connector.

The CT may operate as long as it is powered on or only while ignition signal is available. This behavior depends on specific vehicle types and must be configurable.

4.7.2. Optimized Consumption

Possibilities for optimized power consumption, depending on availability on specific hardware, are:

- CPU clock and voltage rating
- Deactivation of unused peripherals (HDDs, USB HIDs)
- Reduction of brightness
- Idle time until display is switched off
- Idle time until hibernation
- Robust mode, only using subset with reliable peripherals

The power management should foresee different CT Power Modes which define the applicable behavior for power up, shutdown and consumption optimizations for the different vehicle use cases.

These could be defined as:

1. Silent
2. Combat
3. Standby
4. Emergency

ANNEX A ABBREVIATIONS

AAC	Advanced Audio Coding
AEP	Allied Engineering Publication
ALARP	As Low As Reasonably Practicable
BIT	Built in Test
CI	Configuration Item
CM	Configuration Management
COIN	Counter Insurgency Operations
CONOPS	Concept of Operations
COTS	Commercial Off The Shelf
CR	Compulsory Requirement
CT	Crew Terminal
DC	Direct Current
DDS	Data Distribution Service
DDSI	Data Distribution Service Interoperability
Def Stan	Defense Standard
DM	Data Model
ECM	Electronic Counter Measures
EDA	European Defense Agency
EMC	Electro-Magnetic Compatibility
EU	European Union
GPS	Global Positioning System
GVA	Generic Vehicle Architecture
HID	Human Interface Device
HMI	Human Machine Interface
HUMS	Health and Usage Monitoring System
IDL	Interface Definition Language
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
ISO	International Standards Organization
ITT	Invitation to Tender
IV&V	Independent Verification and Validation
KSR	Key System Requirement
KUR	Key User Requirement
LAN	Local Area Network
LRU	Line Replacement Unit
MDA	Model Driven Architecture
MILVA	Military Vetronics Association
MNRC	Multi-national Research Centers
MOD	Ministry of Defense
MOTS	Military Off-The-Shelf
N/C	Not Connected
NAAG	National Army Armament Group
NATO	North Atlantic Treaty Organization
NGPOC	NGVA Point of Contact
NGVA	NATO Generic Vehicle Architecture

NSA	NATO Standardization Agency
NSO	NATO Standardization Office
NTA	Network Technical Authority
OE	Optional Enhancement
OMG	Object Management Group
PCM	Pulse-Code Modulation
PDT	Power Distribution Terminal
PE	Platform Equipment
PIM	Platform Independent Model
PLEVID	Platform Level Video Distribution
POSIX	Portable Operating System Interface
PSM	Platform Specific Model
RFC	Request for Comments
RoHS	Restriction of Hazardous Substances
SA	Situational Awareness
SAE	Society of Automotive Engineers
SIP	Session Initiation Protocol
SNMP	Simple Network Management Protocol
SRD	System Requirement Document
SSDD	System/Subsystem Design Description
SSS	System/Subsystem Specification
TA	Technical Agreement
TE	Terminal Equipment
UML	Unified Modeling Language
USB	Universal Serial Bus
VMS	Vehicle Mission System
VOX	Voice Operated Transmission
VSI	Vehicle Systems Integration Standards & Guidelines
WG	Working Group(s)

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