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TOWARDS A NEW NATO CERTIFICATION CAPABILITY FOR HLA
Background

• Integration of distributed simulations and tools into interoperable federations is a complex and time consuming task.

• A certification service provides an unbiased compliance testing against standard sets of interoperability requirements.

• Certification process is available for the HLA (High Level Architecture) standard versions 1.3 and IEEE 1516-2000 (certification tools provided by USA).

• **No certification support for HLA IEEE 1516-2010.**

• NATO initiative to define a new process and to develop a new certification tool.
Scopes of certification

- Level 5: Conceptual Interoperability
- Level 4: Dynamic/Pragmatic Interoperability
- Level 3: Semantic Interoperability
- Level 2: Syntactic Interoperability
- Level 1: Technical Interoperability
- Level 0: No Interoperability

New Scope of HLA Certification

Legacy Scope of HLA Certification
NATO MSG-134

NATO Distributed Simulation Architecture & Design, Compliance Testing and Certification

Objectives:

• Development of Integration Verification and Certification Tools,

• Maintenance of NATO Education and Training Network Federation Architecture and FOM (Federation Object Model) Design Document (FAFD),

• Provision of persistent test and integration network to support FAFD development and test, verification and certification activities.
NETN FOM and AMSP-04

- NATO Education Training Network (NETN) FOM (Federation Object Model) defined by NATO Modelling & Simulation Group from 2007 to 2014.
- Modular FOM based on RPR-FOM v2.0.
- Already used by nations (SWE, FRA…).
- The NETN Federation Architecture and FOM Design (FAFD) will be published in 2016 as a NATO Allied Modelling and Simulation Publication (AMSP-04) covered by a NATO Standardization Recommendation (STANREC-4800).
Integration - Verification - Certification

• **Federate Integration Assistance**: By using the monitoring and testing capabilities of a certification tool, a federation integrator is provided with better control, diagnostic and documentation functions. Essentially, it will be easier to identify federates behaving outside their conformance statements. The certification tool will also facilitate the integration of certified federates in an overall new federation.

• **Federate Verification Assistance**: By using the test cases definition and execution framework of a certification tool, federate users can verify the application behavior. In simple cases, this can be done by using the given standard use cases. But in more complex tests, the generic test case development framework can be used to create specific validation test cases for specific application logic.

• **Federate Certification**: Done by a Certification Entity and supported by an Accredited Test Laboratory in charge of conducting the certification process.
Concept of Operation (CONOPS)

- Description of the business model of the proposed Integration Verification & Certification Tool (IVCT) software and the execution of the certification process including the individual roles and responsibilities in the NATO and Nations.
Key components

- A Interoperability **Capability Badge** (CB) is defined as a token of achievement in terms of passing testing related to Interoperability Requirements associated with the CB.

- A Simulation **Interoperability Requirement** (IR) is related to how distributed systems interact and exchange information in order to collectively meet overall simulation objectives. IRs are associated to Test Cases.

- A **Test Case** (TC) is a sequence of HLA object exchanges (publish / subscribe) and interactions which covers a part of HLA services and/or FOM.
## Examples of Capability Badge

<table>
<thead>
<tr>
<th>ID</th>
<th>Dependency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLA-BASE-2016</td>
<td>-</td>
<td>Basic Conformance Statement / SOM and Best Practices compliance</td>
</tr>
<tr>
<td>NETN-AGG-2016</td>
<td>RPR-AGG-2016</td>
<td>NETN-FOM v2.0 Aggregate FOM Module</td>
</tr>
<tr>
<td>NETN-ENTITY-2016</td>
<td>RPR-ENTITY-2016</td>
<td>NETN FOM v2.0 Physical FOM Module</td>
</tr>
<tr>
<td>NETN-MRM-2016</td>
<td>NETN-TMR-2016</td>
<td>NETN FOM v2.0 MRM FOM Module</td>
</tr>
<tr>
<td>NETN-TMR-2016</td>
<td>HLA-BASE-2016</td>
<td>Basic support for NETN TMR (Transfer of Modelling Responsibility) pattern (AMSP-04 Ed A). Simulation under Test is able to respond to TMR requests.</td>
</tr>
<tr>
<td>RPR-AGG-2016</td>
<td>HLA-BASE-2016</td>
<td>RPR-FOM v2.0 Aggregate FOM Module</td>
</tr>
<tr>
<td>RPR-ENTITY-2016</td>
<td>HLA-BASE-2016</td>
<td>RPR-FOM v2.0 Physical FOM Module support. GRIM compliance with relation to Platforms, Lifeforms etc. representation of required attributes.</td>
</tr>
</tbody>
</table>
Example of abstract test case

NETN TMR Trigger Test

SuT with multiple federates will need to be tested for each federate.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Start SuT</td>
</tr>
<tr>
<td>2</td>
<td>Start IVCT</td>
</tr>
<tr>
<td>3</td>
<td>IVCT connects to RTI</td>
</tr>
<tr>
<td>4</td>
<td>IVCT joins federation execution</td>
</tr>
<tr>
<td>5</td>
<td>IVCT publish NETN object classes</td>
</tr>
<tr>
<td>6</td>
<td>IVCT register instances of NETN object classes</td>
</tr>
<tr>
<td>7</td>
<td>IVCT publish and subscribe to NETN TMR interactions</td>
</tr>
<tr>
<td>8</td>
<td>IVCT waits for a TMR_InitiateTransferModellingResponsibility interaction with specified instances and attributes owned by IVCT and the transfer type is Divest</td>
</tr>
<tr>
<td>9</td>
<td>IVCT response with a TMR_OfferTransferModellingResponsibility</td>
</tr>
<tr>
<td>10</td>
<td>IVCT sends a TMR_TransferResult</td>
</tr>
</tbody>
</table>
Extended Certification

Certification for HLA 1.3 & IEEE 1516-2000

Certification for HLA IEEE 1516-2010
IVCT Development

• IVCT developed under Open Source license (Apache 2.0).

• Collaborative development among the NATO MSG-134 members.

• Use of GitHub to manage and share the code source.

• First executable test cases developed for HLA IEEE 1516-2010 services, RPR-FOM and NETN FOM.
NATO Simulation Interoperability Test and Certification Services

- Certification Entity
- User Interface
- Test Case Reporter
- Scheduler
- Test Case
- Test Case Engine
- IVCT Internal Communication
- HLA RTI
- System Under Test (including its environment)
- Badges
- IVCT Components

System Operator

Certification Operator

Reports

Badge Designer

Test Case Developer
Way ahead

• First use to support the NATO CWIX 2017.
• Initial certification process and tool will be delivered by the end of 2017.
• Set up of the new certification process in NATO (draft, to be confirmed):
  o **Accreditation Authority (AA): NATO Modelling and Simulation Standards Subgroup (MS3)**
  o **Certification Entity (CE): NATO Modelling and Simulation Center of Excellence (M&S CoE)**
• Stringent necessity that NATO participating nations agree to utilize the HLA compliance certification process and that they agree to enforce the HLA Certification Process on a national level (see STANAG 4603).