VIntEL: An Environment for Distributed Collaborative Simulation Integration and Application

Dr. Eckehard Neugebauer
IABG – VG14
Schießplatz
49716 Meppen
Germany

neugebauer@iabg.de

ABSTRACT

VIntEL stands for "Verteilte Integrierte Erprobungs Landschaft" (Distributed Integrated Testing Environment). VIntEL is part of the Simulation- and Test-Environment which will support the Transformation Process of the German Armed Forces. The first demonstration of VIntEL took place successfully in October 2004. In this experiment a constructive simulation system was federated with several virtual platform simulators and real systems in order to investigate the performance of different types of unmanned reconnaissance vehicles in a typical tactical environment. The systems were distributed over four locations (two sites in Meppen, one in Lichtenau and one in Greding). Federating of these systems by distributed working teams took only six weeks using the PSISA middleware to create the HLA interfaces of the HLA-federates and using two different RTIs (GERTICO and DMSO). A suitable subset of the RPR FOM was used. This first VIntEL experiment demonstrated the feasibility of an effective, distributed and collaborative development of a federation of different simulation systems and real systems. Further experiments using expanded simulation infrastructure functionalities are planned for 2005 and 2006.

1.0 INTRODUCTION

Rapidly changing employment conditions of our forces require swift and efficient development and acquisition of new capabilities to deal with new challenges. Modeling and simulation (M&S) technology is a key enabler to support this. Pre-requisite for an efficient usage of M&S is an application-oriented Integration Environment which provides the correspondingly suitable simulation tools.

VIntEL stands for "**V**erteilte **Int**egrierte **E**rprobungs **L**andschaft" (Distributed Integrated Testing Environment). VIntEL is part of the Simulation- and Test-Environment which will support the Transformation Process of the German Armed Forces. This environment embraces laboratories for Concept Development & Experimentation (CD&E) and testbeds for Demonstration, Prototyping & Experimentation (DP&E). Collaborative experimentation and testing joins military users across all military levels, engineers of the armament sectors and in case defense-relevant industrial producers. This collaboration is one basic pre-requisite for a successful transformation process.

VIntEL allows to bring together military and technical experts in order to assure continuous and consistent top down flow of information regarding new scenarios, new concepts of operations and corresponding requirements, and bottom up flow of information regarding restrictions, boundary conditions and new ideas (fig. 1).

Neugebauer, E. (2005) VIntEL: An Environment for Distributed Collaborative Simulation Integration and Application. In *The Effectiveness of Modelling and Simulation – From Anecdotal to Substantive Evidence* (pp. 17-1 – 17-8). Meeting Proceedings RTO-MP-MSG-035, Paper 17. Neuilly-sur-Seine, France: RTO. Available from: http://www.rto.nato.int/abstracts.asp.

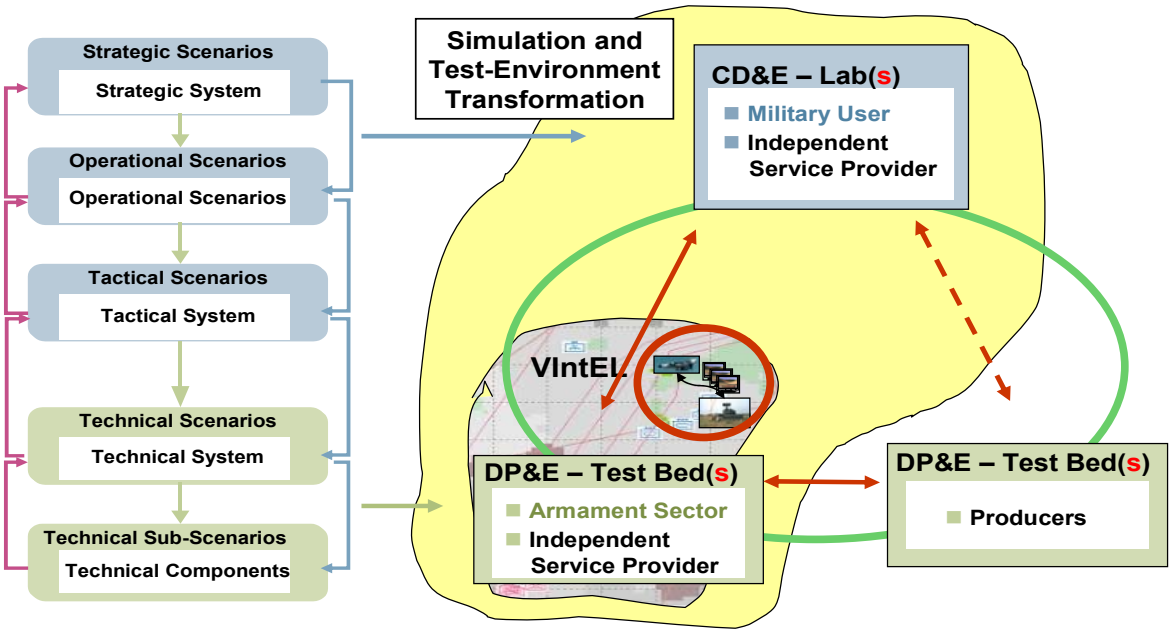

Figure 1: Connections between CD&E, DP&E and VIntEL

VIntEL supports – on the one hand – military sponsors in defense analysis and planning at the tactical level and below, particularly in the early stages of the development and acquisition processes. On the other hand, VIntEL supports the armament sector and defense industry in the development of technical system requirements as well as in examination and verification of the performances of proposed system concepts.

In a first demonstration of VIntEL a constructive simulation system (PABST 2000) was federated with several virtual platform simulators and real systems in order to investigate the performance of different types of unmanned reconnaissance vehicles in a typical tactical environment.

2.0 THE FIRST VINTEL EXPERIMENT

In October 2004, a one-day-demonstration took place, showing the feasibility of the VIntEL-concept (see also [1]).

The involved systems were distributed over four locations all over Germany (two sites in Meppen, one in Lichtenau and one in Greding, see figure 2). Table 1 gives the main characteristics and some relevant details of these systems. Figure 3 shows the structure of the LAN/WAN-connections of the participating systems.

Federating of these systems by distributed working teams took only six weeks. These teams were distributed at the above mentioned locations using the PSISA middleware to create the HLA interfaces of the HLA-federates using two different RTIs (GERTICO and DMSO). A suitable subset of the RPR FOM was used.

Table 1: The systems used in the first VIntEL-experiment in October 2004

system	type of system	provided by	role in the scenario
LAN Meppen (WTD 91 and IABG Office):			
PABST 2000	constructive simulation (computer-generated forces)	IABG Ottobrunn	1. generation of 14 BMP 2 (red forces) 2. presentation of overall situation (ground and/or perceived truth)
ATV BOXER	virtual simulation with VR-components	WTD 91, Meppen	command-post vehicle of the blue forces
UV 1 & 2	virtual simulations	IABG Meppen	unmanned recce vehicles (blue)
AFV MARDER	virtual simulation		part of armored infantry platoon (blue)
invisible viewer	virtual simulation		neutral experiment observer
WAN connection via VPN to IABG Offices in Lichtenau:			
AAT ROLAND	DEKAS (replay of recorded real data)	IABG Lichtenau	air defense (blue)
Air fighter MIG			air attack (red)
AFV MARDER	virtual simulation	IABG Meppen	part of armored infantry platoon (blue)
WAN connection via ISDN to WTD 81 in Greding:			
AAT GEPARD	real system	WTD 81, Greding	air defense (blue)

Figure 2: Geographical distribution of the participating systems and of the scenario

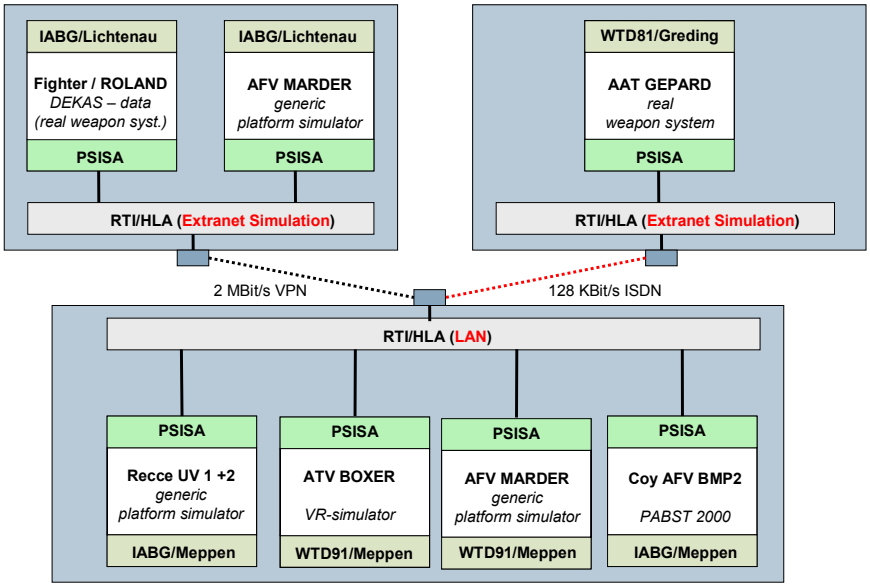

Figure 3: LAN-/WAN-connections of the participating systems

Besides the availability of the RPR FOM, the middleware PSISA played a key role for the rapid generation of the VIntEL federation (see figure 4). It allows a very simple insertion of those functions necessary for the dynamic coupling of a simulation system via alternative interfaces to the outside world (e.g. for the translation of units, mapping of the variables to the attributes of the classes of the respective FOM, time advancement control, generation and dynamic handling of ghost objects (dead reckoning), etc.).

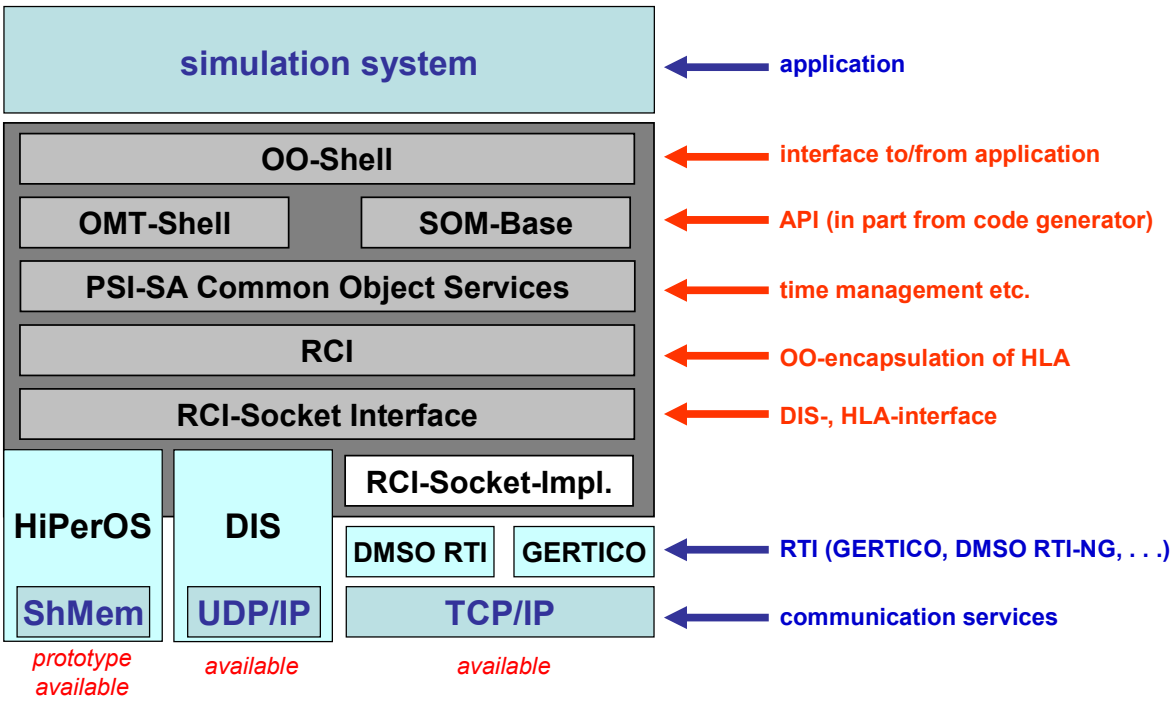

Figure 4: Layered structure of the middleware PSISA

In this case the HLA-FEDEP, the middleware PSISA, the GERTICO RTI, the DMSO RTI and the RPR FOM could be seen as parts of an Integration Infrastructure for rapid collaborative federation building.

At the demonstration, the following fictive scenario was played (see figure 5):

1. One hostile company with 14 BMP 2 is situated SE of Tauberzell.
2. The blue forces are situated in the West of Tauberzell with a reconnaissance platoon, consisting of one CP-vehicle (an ATV BOXER), two AFV MARDER and two different unmanned reconnaissance vehicles. In addition, there are two AAT (one ROLAND with AA missiles and one GEPARD with AA gunnery).
3. It is unclear to the blue forces, if the village Tauberzell is occupied by red forces. So one unmanned recce vehicle is sent through the village, protected by the two AFV MARDER. The recce vehicle detects one hostile BMP 2.

4. Since it is quite probable that there is another BMP 2, the second recce vehicle is sent out. This vehicle is constructed differently, has a higher optronics system and detects the second BMP 2.
5. The red forces notice that they got detected and send an air fighter in order to destroy the recce platoon.
6. The air fighter is tracked by the AAT ROLAND, which fires two missiles at the fighter. The fighter gets hit and changes its course.
7. The AAT GEPARD tracks the air fighter without shooting at it.
8. The two AFV MARDER circumvent Tauberzell in the North and destroy the two detected BMP 2.

The idea behind this scenario is, to test some new weapon systems (which might be still under development; in this case: the unmanned recce vehicles) in a simulated, but realistic tactical environment.

The time duration of this scenario was about one hour.

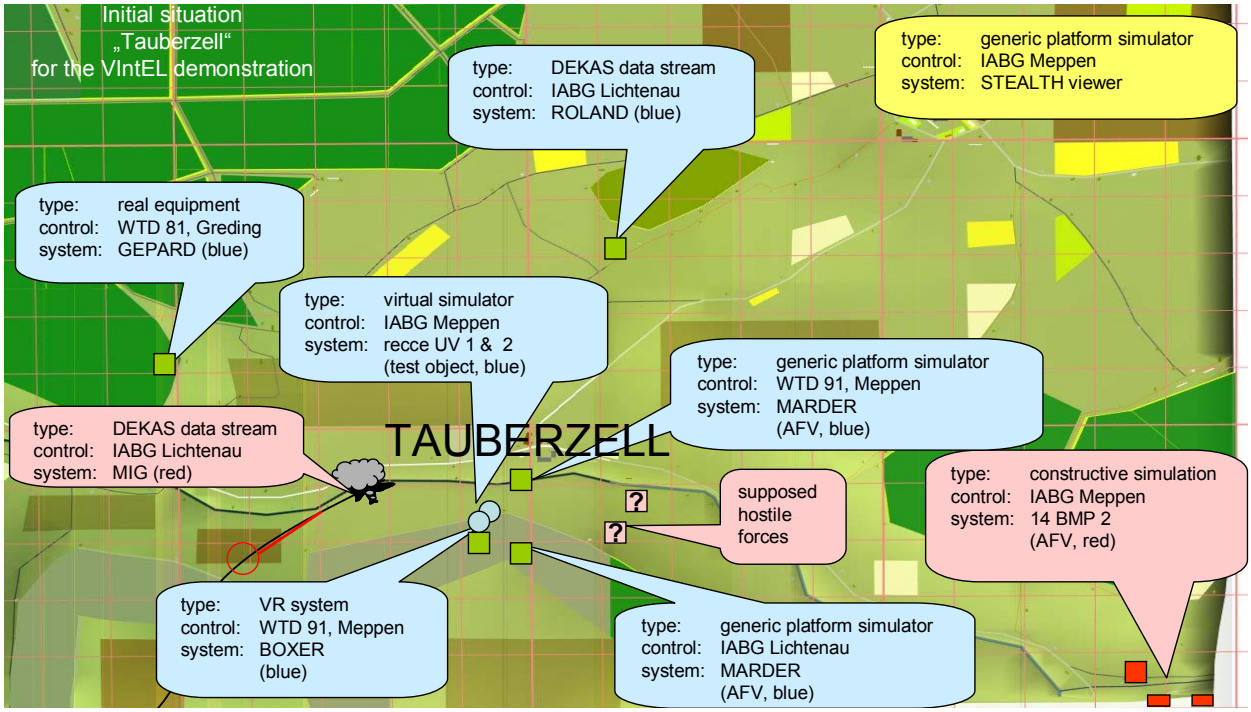

Figure 5: Sketch of the scenario (initial situation)

3.0 CONCLUSIONS AND WAY-AHEAD

The first VIntEL experiment was a success. It demonstrated the feasibility of an effective, distributed and collaborative development of a federation of different simulation systems and real systems.

Those federations are necessary tools for CD&E as well as DP&E.

Further experiments using expanded simulation infrastructure functionalities are in preparation and will be conducted in 2005 and 2006.

REFERENCES

[1] K. Pixius, D. Grönninger, U. Krosta, H. Henrich, H. Ufer, W. Wassmuth: "An HLA-based Distributed Proving Ground to support the German Federal Armed Forces' Procurement Process", Paper 05S-SIW-053, 2005 Spring Simulation Interoperability Workshop, San Diego, CA, April 2005

GLOSSARY

AAT	Anti-Air Tank
AFV	Armored Fighting Vehicle
ATV	Armored Transport Vehicle
CD&E	Concept Development & Experimentation
DEKAS	**D**aten**e**rfassungs-, **K**opplungs- und **A**uswerte**s**ystem (System for Data Collection, Storage and Retrieval)
DP&E	Demonstration, Prototyping & Experimentation
GERTICO	**Ge**rman **RTI** is based on **CO**RBA
PSISA	Proposed Standard Interface for Simulation Applications
UV	Unmanned Vehicle
VIntEL	**V**erteilte **Int**egrierte **E**rprobungs**l**andschaft (Distributed Integrated Testing Environment)
WTD	**W**ehr**t**echnische **D**ienststelle (Bundeswehr Technical Center)
WTD 81 in Greding	Bundeswehr Technical Center for Information Technology and Electronics
WTD 91 in Meppen	Bundeswehr Technical Center for Weapons and Ammunition