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Virtual Research Laboratory (VRL)

Protocol for PhD research at the VRL

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General issues

This protocol summarizes the *measures and procedures* which apply for planning, organizing, and execution of PhD research decided, planned, or proceeded on the VRL cloud platform. This protocol consists of three sections for *overall issues* (Section 1)*, PhD research preparation activities* (Section 2)*, and on-going PhD research related issues* (Section 3). It includes VRL research specific procedures and measures, and does not include protocol for definition of the research plan itself.

This protocol is provided as a document specific for research at VRL serving not well-known issues which are not included in any other document at DSAIAM. VRL is an attempt to *apply science-intensive engineering modeling platform as PhD research laboratory* where any contribution is placed in a highly integrated ready to execute reactive experimental model which inherently does not accept documents and passive engineering models as contribution.

The basic idea of PhD at VRL is *research in real world originated topic* preferably from leading research intensive industry using *principles, methodologies, and laboratory environment* which are applied there. In this way, *VRL is an initiative and by now result of an extensive research* to the introduction of theories, methodologies, systemics, and software which have been developed at leading aircraft, car, and other companies among others to include fundamental and problem solving research in engineering for highly automated products during the past decades. *Application of the VRL platform as research laboratory is essentially different from the original* product development engineering *purpose of the same platform*.

The main methodology at VRL is the *three-paradigm PhD research where theoretical and experimental research are organized by experimental model to make integrated application of contemporarily leading theories, methods, systems, practices, applications, and experience possible.* Integration is a key issue to replace the former automated island type solutions which are not suitable neither virtual nor cyber controlled physical environments anymore. The PhD program of the VRL well fits to scientific-engineering profile of research at the DSAIAM.

The VRL platform applies theories, methodologies, and solutions which were well-proved in engineering informatics at world level projects managed by aircraft, car, and other leading companies. In this way, concepts and terms in this protocol are well-defined. Modeling and other activities are ready to apply at PhD research practice on the VRL platform. The VRL platform is now available to accommodate DSAIAM accepted PhD research by enrolled students who are aware of the work on VRL platform and take on this challenge.

Section 1: Overall issues

1.1. *VRL is a unit in the organization of DSAIAM. The rules, measures, and activities mandatory for PhD students at the DSAIAM apply for any research at the VRL*.

1.2 *The PhD program of the VRL* and *other materials placed on the website of VRL* are mandatory to study by PhD students to understand issues regarding research at VRL.

1.3. *Issues [in scientific publications about VRL](#)* relevant to the research of a PhD student are mandatory to study and cite when applied at any time during the research.

1.4. PhD student *works on the scientifically renewable, comprehensive, and inherently very complex VRL platform* which acts as all-in-one solution for PhD research. VRL platform is operated by the Dassault Systémes S. A. (DSS), and managed by professionals in the cloud of DSS.

1.5 *Enough time must be allowed for PhD student* to reach the necessary level of thinking and seeing in the platform, to get the required knowledge and experience for the research, and to configure own PhD research environment in the platform. VRL represents specific and novel research methods, processes, and laboratory system where essentials are still not well-known and understood.

1.6 *PhD student submits supervisor signed research plan* which includes *specifics of VRL research* in addition to the usual plan which should be elaborated in accordance with the relevant [protocol effective at the DSAIAM](#).

1.7 *VRL was founded for three paradigm scientific-industrial translational research* in applied informatics and applied mathematics. *Company or institution originated PhD topics are preferred* which represent real world actual demand for research. Research topics and expert supervisors preferably come from companies or institutions which do research on the same or compatible platform as operates at VRL. Expert person at s*ource of a topic* preferably *controls the PhD research among others to enhance results in application related issues, offers or supports application of research results, and provides capacities to accomplish physical experiments somewhere outside of the VRL platform.*

1.8 *PhD student, supervisor, and any other participant of research does work in the collaborative space* defined for the PhD research, or in one of the other collaborative spaces which are connected to the collaborative space of the PhD research. Collaborative space, connections between collaborative spaces, and participant profiles are configured using capabilities available in the VRL platform.

1.9 *Any content item is organized, communicated, and protected in the collaborative space* which is configured for the research of PhD student*. Any participant is granted personal credentials for collaborative spaces, responsibilities, and the organization.* Participant can work in different collaborative spaces with different credentials. Responsibilities define what content developing and administrative tasks can participant do in a collaborative space in accordance with granted roles.

1.10 In accordance with strong current trends, *PhD research at VRL serves high level and highly integrated automation which requires contextual, reactive, and autonomous experimental model* to represent objects, features, contexts, and behaviors using comprehensive modeling, simulation, and other capabilities as available at the VRL platform. PhD student continuously develops experimental model to define, develop, verify, and apply research results during the extended lifecycle (See 3.13) of PhD research.

1.11 The VRL platform is configured, updated, and upgraded on the 3DEXPERIENCE cloud platform of the Dassault Systémes S. A (DSS). The central platform management at DSS grants SaaS, PaaS, IaaS, collaboration, scalability, flexibility, server improvement, cross-applications, and maintenance services for the own VRL platform. In case of new granted item financial expense may be emerged. *PhD student and any other participant works in this environment in the possession of knowledge enough for the actual PhD research.*

1.12 *The local platform management at VRL works* in accordance with platform rules and in cooperation with the DSS central platform management. Relevant protocol is applied and autonomously enforced at this cooperation. PhD student works on the VRL platform undergoing the relevant rules in professional, disciplined, and honesty manner. It should be kept in mind that VRL platform is a showcase of the DSAIAM and so the Óbuda University.

1.13 Because credentials, collaborative space, and content items are created and managed on the VRL platform in the cloud of DSS and not in a system on the premises of the *Óbuda University, relevant specific measures may be apply for VRL activities*.

1.14 *Geographically and organizationally unlimited participation* at PhD research in collaborative space on the VRL cloud platform requires compliance with all applicable regulations during the extended lifecycle of PhD research.

1.15 *Essentially, VRL moves the PhD research to where the related research really proceeds and the necessary expertise, human assistance and engineering platform are available.* This provides among others solution for critical shortages

in these issues. While PhD student research remains in the organization of the DSAIAM, no unfeasible journey of the supporting participants is required. At the same time, potentials of VRL platform capabilities and the model communicated research ensure results better than any former method could.

1.16 VRL serves integrated automation so that *research results must be suitable for integration in large-scale structures* utilizing model mediated communication in experimental model and in its contextual environment.

1.17 PhD student who enrolled in one of the VRL research topics also acts as member of the *VRL research group*. *PhD student contributes to introduction of research at VRL and to local platform management tasks* under instruction of laboratory leader and in accordance with the possible specific agreement between student and DSAIAM. Found must be provided for the support of these activities.

1.18 *Activities on the VRL platform are organized and coordinated by the VRL leader*, who must be in the possession of thorough and workable knowledge about the platform, including its two-levels management as well as the comprehensive theoretical, methodological, and systemics background of the relevant modeling and simulation. *VRL leader assists supervisor to instruct the PhD student* about experimental model-based issues.

1.19 *To be able to work in collaborative space* of PhD research, *supervisor* and other assistance must be in possession of knowledge required to instruct PhD student at modeling and simulation relevant to the actual research.

1.20 *This protocol includes concepts, objects, and activities those are not general ones but directly related to relevant research capabilities on the platform*. VRL applies theories and methodologies which have been developed in large projects on highly automated aircraft, car, and other products at world leading companies and institutions offering great chance to realize world level PhD research at VRL.

Section 2: Activities to prepare PHD research

2.1. Proposed *PhD topic and* supervisor information can be submitted by a company or an institution partner for approval by the Council of the DSAIAM in accordance with rules measures and procedures effective at the DSAIAM.

2.2 [Accepted *PhD topics and* supervisors](#) for these topics are available for applicants at VRL.

2.3 PhD applicant selects topic and supervisor from the *choice offered by companies and institutions (2.1) or by the VRL (2.2)*. Alternatively, *applicant can propose own VRL conform topic and prospective supervisor for approval*. Rules for topic and supervisor selection are available for applicants in the material "[For the attention of our applicants who choose topic and supervisor!](#)".

2.4 *PhD applicant prepares and submits preliminary [research plan](#) specifically for research at the VRL* in accordance with this protocol and in cooperation with the prospective supervisor who signs it. Research plan should be submitted as one of the DSAIAM application documents.

2.5. When the application is accepted and the PhD student enrolled at the DSAIAM, *PhD student will be granted participant status for the VRL platform*. Compliance with the central and local platform rules is mandatory.

2.6 *Collaborative space is defined for the PhD research* using capabilities available at the VRL platform. Assistance by the local platform manager is available.

2.7 *PhD student defines initial experimental model* to prepare and placing content items in the collaborative space using capabilities available at the VRL platform. Assistance by the supervisor is available.

2.8 *PhD student elaborates VRL specific starting research plan* in coordination with the approved supervisor and places it in the experimental model. This plan is called as starting one because it can be modified during the research as required by developing strategies using platform capabilities to modify the experimental model in compliance with the rules effective at VRL platform and DSAIAM. *Research plan is active at control of research process.*

2.9 *PhD student selects a starting set of modeling, simulation and other APPs* which is necessary to start the research. When it is necessary, completing the choice of APPs available at the VRL platform can be requested at the central platform management. Financial expense may apply. Assistance by the local platform manager is available.

2.10 *Local platform manager assists PhD student at selecting roles from the choice available at the VRL platform, completing these roles from the DSS platform, and preparing user defined roles* in accordance with the starting research plan. Local platform manager requests grant of the necessary roles at the central platform management for the PhD student and other participants. The *only possibility to access an APP is to include it in one or more granted roles.*

2.11 *PhD student selects outside of platform solvers* (Matworks, Dymola, Etc.) as it is required by the research using open capabilities of the VRL platform. Where there are not any means for the connection of a demanded solver in the platform, the connection is defined by the student using platform capabilities.

2.12 *Collaborative space of the research is configured* using capabilities available at the VRL platform, considering participants, content items, and planned and arranged connections with other collaborative spaces. Assistance by the supervisor is available.

2.13 *During research, PhD student or other participant places and organizes any content in the actual collaborative space* of the PhD research including model units, simulation structures, research plans, experiment plans, outside contexts, research results, and other groups of the content items required. The actual contextual, reactive, and autonomous experimental model is continuously developed during research.

2.14 *There is no alternative of the above organized environment in the VRL platform.* Ad-hoc activities bypassing the organized profile of any participant or the collaborative space are not allowed at the VRL platform. This is not only a local decision at the VRL but also an essential feature of the platform to enforce work of participants in organized, expandable, and sufficiently protected environment.

Section 3: On-going PhD research related issues

3.1 PhD r*esearch proceeds on the VRL platform* which is available as prepared to execute the research plan for the approved participants as it is written in Section 2 of this protocol.

3.2 PhD student prepares *research result related and other necessary model definitions then applies relevant activities on the relevant activity bar in appropriate APPs* to *represent* and organize these *definitions* in the actual experimental model as content elements in the actual collaborative space.

3.3 *PhD student is responsible for contextual, reactive, and autonomous behaviors of ready to execute experimental model at any time during the research.* Supervisor and other supporting persons join to model mediated collaborative work in the collaborative space.

3.4 Configuration of environment for a PhD research, method of experimental model definition, organized contextual connections, and VRL connecting context structures *can be approved as research results in the thesis when they carry enough scientific content*.

3.5 *PhD student can define and arrange physical experiments, as they are necessary in the research*. Although physical experiments are executed *outside of the VRL platform,* they should be included in the actual research plan by proper information about the selected, reserved, and suitably CPS eligible external capabilities and capacities.

3.6 *PhD student preferably applies online executed and experimental model based presentation at end semester reports and defense as evidence of results.*

3.7 *VRL inherently and essentially acts as scientific-industrial knowledge center* which is based on knowledge reuse capabilities of the VRL platform. Knowledge reuse is a fundamental feature of modeling and simulation at the platform. *Ownership and intellectual property related capabilities available in the APPs must be applied to handle these issues.* Patenting should be considered where it applies.

3.8 *In-depth study of the latest and frequently renewed modeling, simulation, and other research capabilities as available in the VRL cloud platform is required* to ensure up-to-date and appropriate scientific level of research and its results.

3.9 *PhD research at VRL inherently utilized results of the latest paradigm shifts* which determined the development of engineering purposed IT during the recent decades. The VRL platform supports this objective by its key capabilities such as feature driven model representation, driving object parameters by mathematical and other scientific context representation, model representation of experience proven theory, behavior representation driven system-level

model, situation-driven decision in model, realistic multiphysical simulation structure, and bionics including organic object representations.

3.10 *PhD student applies scientific level realistic simulation* to make responsibility for autonomous operation of models including represented objects empowered by increased AI content possible.

3.11 *PhD student ensures consistency of the actual experimental model at any time during the research.* Any contribution must be accommodated by the actual reactive autonomous experimental model. In case of contribution refused by the experimental model, relevant previously accommodated content items are allowed to revise to achieve approval of a new contribution.

3.12 It is important to keep in mind that *the VRL platform works in the cloud of the DSS while PhD student and other participants communicate with the VRL platform using relevant capabilities of client workstations. To do this communication, client workstation must be suitably equipped* with specified hardware and software systems as well as platform conform client capabilities. Any update of the VRL platform by the central platform management requires update the client workstations accordingly. VRL platform is updated and upgraded by central platform management typically on Saturday to allow time for the local platform management to update the client workstations to start work on Monday. PhD student does this mandatory activity in client workstations assigned. Assistance by the local platform manager is available. The VRL cabinet provides appropriate and protected client workstations for streamlined and secure work on the VRL platform. Research on personally owned or hired client workstation may be permitted for PhD student with own responsibility.

3.13 *Industrial or other application of PhD research results has outstanding and continuously increasing importance.* Contextual communication should be established between experimental model at VRL and already decided or only prospective cyber physical or other application environment. This communication may be defined on different levels of cooperation between experimental model and application environment using VRL platform capabilities. Lifecycle of PhD research is extended to experimental, prototype, and even normal operation of PhD research results.

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