



VR-Forces 4.10 Release Notes

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Systems Supported

This section describes platform support and system requirements for VR-Forces. To take full advantage of VR-Forces's visualization capabilities and optimize performance, you must use a modern game computer with a high quality NVidia graphics card.

For the most up-to-date information about systems supported, see the Product Versions page on the MAK web site at: <https://www.mak.com/support/product-versions>. For hardware requirements, see <https://www.mak.com/support/hardware-recommendations>.

VR-Forces 4.10 is available for the platforms listed in Table 1. For toolkit users, application code must be built with the indicated compilers in order to link to VR-Forces libraries.

Table 1: Platforms supported

Operating System	Compiler
Windows 10	Microsoft Visual C + + 15.0 (64-bit)
Red Hat Enterprise Linux 8.0 (64-bit libraries)	default compiler

3D Video Cards Supported

VR-Forces 4.10 supports NVIDIA graphics cards that support OpenGL 4.5 VR-Forces does not support AMD (formerly ATI) graphics hardware.

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VR-Forces strives to provide the best 3D scene quality possible and cutting edge visualization effects. To provide this functionality, VR-Forces takes advantage of OpenGL features that may not be supported on older video cards. When this is the case, you can disable these features, allowing VR-Forces to run in 3D modes.

OpenGL 4.5 is the minimum requirement for rendering a 3D scene in VR-Forces. For the best visual quality and highest performance you should use the most recent NVIDIA GeForce card. The minimum recommended card is the 9xx series.

Some laptops have an NVIDIA graphics card and an Intel graphics card. You must configure your computer to use the NVIDIA card. To do so:

1. Open the NVIDIA Control Panel (in the System Tray).
2. Select Manage 3D Settings.
3. Select Global Settings.
4. Select Preferred Graphics Processor.
5. Select High-performance NVIDIA Processor.



You should always try to use the latest drivers available for your video card.

Using Kepler Series Quadro Cards

There is a known issue with the Quadro drivers on Kepler series Quadro cards. NVIDIA says its related to the fact that the default profile optimizes for a fixed eyepoint (for applications like CAD). To run on these cards, you must change the global profile for the driver, as follows:

1. Open the NVIDIA Control Panel.
2. Select the Manage 3D Settings page.
3. Select the Global Settings tab.
4. In the list of driver profiles, select Workstation App - Dynamic Streaming.

We are working with NVIDIA to have their drivers recognize our applications and apply this profile automatically. In the meantime, for Kepler series Quadro you must make this change manually.

Disk Space Requirements

A full installation of VR-Forces requires approximately 35 GB of disk space.

Compiler Compatibility on Windows

MAK provides versions of product releases that have been compiled with different versions of Microsoft Visual C++ (for example, 12.0, and 15.0). When you run MAK products together on the same computer, for example, VR-Forces and VR-Vantage Stealth, we strongly recommend that you run versions compiled with the same compiler. Mixing products compiled with different versions of the compiler can result in program instability.

Required Software for Toolkit Users

If you plan to build VR-Forces applications using the VR-Forces Toolkit, you must download and install VR-Link 5.7.

If you plan to build the VR-Forces GUI, you must download and install Qt 5.10.1 (Windows) or 5.14.0 (Linux). You can download it at:
<http://www.mak.com/support/bonus-material>.

Qt is also available as a free download under the LGPL version 2.1 license at <https://www.qt.io>. This version should be satisfactory for most VR-Forces customers. If you need a Qt commercial license, you must purchase the license from Qt.

MAK Product Compatibility

To build VR-Forces applications, you must link with VR-Link 5.7. If you are building for HLA and want to link with the MAK RTI, use MAK RTI 3.x or later, although we recommend use of the latest release. If you are building for HLA Evolved, you must use MAK RTI 4.0.4 or later.

License Manager

VR-Forces 4.10 uses FLEXlm 11.13.0.2.

The License Manager files are not part of the VR-Forces installer. You can download them at:

- ♦ Windows: <http://ftp.mak.com/out/MAKLicenseManager-win64-setup.exe>
- ♦ Linux: <http://ftp.mak.com/out/MAKLicenseManager-linux64-setup.tar.gz>

A license manager FAQ is available at:

<https://www.mak.com/support/license-support>

Third-Party Libraries Supported

VR-Forces 4.10 uses the indicated versions of the following libraries:

- ♦ VR-Link 5.7
- ♦ Qt 5.10.1 (VC 15), Qt 5.14.0 (Red Hat 8)
- ♦ OpenSceneGraph 3.6.4
- ♦ Boost 1.63.0
- ♦ FreeGlut 2.4.0 (Windows), 2.6.0 (Linux)
- ♦ GL-Studio 7.0 (VC 15)
- ♦ DI-Guy 13.4 (development version)
- ♦ Triton 3.73
- ♦ Silverlining 5.086
- ♦ SpeedTree 6.3.2
- ♦ CDB API 2.2 (Windows), 2.1 (Linux)
- ♦ osgEarth 3.0
- ♦ CUDA 9.2 (Windows), 10.2 (Linux)

Using MAK Products on Virtual Machines

You can run MAK products on virtual machines. For more information, see the Cloud & Virtualization page on our website at <https://www.mak.com/learn/cloud-virtualization>.

Network Compatibility

VR-Forces 4.10 is compliant with RPR FOM 1.0 and RPR FOM 2.0 and includes FOM mappers for many draft versions of the RPR FOM. It is compliant with RTIs that support the HLA 1.3 specification, the SISO DLC HLA API 1516 version of the IEEE 1516 specification (SISO-STD-004.1-2004), or HLA Evolved.

To use an RTI with VR-Forces it must use the same operating system and be built with the same compiler.

VR-Forces 4.10 supports DIS 4, 5, 6, and 7, and can therefore interoperate with DIS applications of any of these versions.

Backwards Compatibility

The VR-Forces 4.10 APIs are largely compatible with earlier VR-Forces 4.x versions, however some changes are required to migrate to 4.10. See the *VR-Forces Migration Guide* for more information.

Scenarios created with recent releases are usually forward compatible. Updates to tasks, systems, and terrain reasoning may change how simulation objects behave.

Support for MAK Data Logger Recordings

The recordings provided with MAK Data Logger 5.4 or later use the new FED file naming conventions (described in *MAK Products Interoperability Guide*). These should work seamlessly with the default HLA configurations in VR-Forces 4.10. If you want to connect VR-Forces 4.10 to recordings made with previous versions of the Logger, you must change the connection configuration to use the old FOM naming convention.

RPR FOM Versions Supported

VR-Forces 4.10 has built-in support for versions 1.0 and 2.0 (drafts 6, 17, and 20) of the RPR FOM and RPR FOM 2.0, draft 17 with DI-Guy extensions. It also supports VR-Link's ability to support alternative FOMs through the FOM Mapper. By default, VR-Forces 4.10 uses RPR FOM 2.0.

If you are building an application with the VR-Forces toolkit and you want to specify a version of the RPR FOM through code, pass the version number (for example, 2.0006) to the *DtFedAmbWrapper* constructor and pass the resulting object to the *DtExerciseConn* constructor. Also, make sure you are using a federation execution name that corresponds to the right FED file. For example:

```
DtExerciseConn conn("VR-Link20006", "MyApp", new DtRprFomMapper(2.0006));
```

In order to support RPR FOM 1.0, we have added the following extensions (which are supported in later versions of the RPR FOM):

- ♦ EnvironmentProcess
- ♦ GriddedData
- ♦ EmbeddedSystem.IFF
- ♦ EmbeddedSystem.IFF.NatoIFF
- ♦ EmbeddedSystem.IFF.NatoIFF.NatoIFFTransponder
- ♦ EmbeddedSystem.IFF.NatoIFF.NatoIFFInterrogator
- ♦ EmbeddedSystem.IFF.SovietIFF
- ♦ EmbeddedSystem.IFF.SovietIFF.SovietIFFTransponder
- ♦ EmbeddedSystem.IFF.SovietIFF.SovietIFFInterrogator
- ♦ EmbeddedSystem.IFF.RRB
- ♦ BaseEntity.AggregateEntity
- ♦ ObjectRoot.BaseEntity.PhysicalEntity.Lifeform

For both RPR FOM 1.0 and 2.0, VR-Forces 4.10 relies on the Controlling and ViewControl custom MAK extensions.

New Features and Updates

VR-Forces 4.10 has the following new features and updates.

Simulation Objects

- ♦ The new Aerodrome and Runway objects for entity-level scenarios allow you to create aerodromes and associate the runways with them. You can also automatically create aerodromes and their runways if they are defined in the terrain. You can control the lighting for the aerodromes and runways. See the Airports and Aerodromes chapter in the *VR-Forces Users Guide*.
- ♦ There is a new feature that you can access through the Edit menu: Subordinate Functions. These are text-based handles that identify a user-defined role or function that the subordinate performs in that unit. When editing units in the Simulation Object Editor, there is a new Function button in the Unit Composition box that you can use to specify a subordinate's function in the unit.
- ♦ There is a new option in the Selected Simulation Engine Toolbar list, Automatic. This is selected by default and, when selected, newly created objects from the front-end will be placed on the least burdened back-end (based on simulation object loads). See "Selecting the Object to Create" in the Creating and Placing Objects chapter in the *VR-Forces Users Guide*.
- ♦ There is a new Set option for human entities under Action: Urgency. This allows you to specify the speed at which a DI-Guy entity should perform animations. See "Urgency (Human)" in the Setting the State of Entity-Level Simulation Objects chapter in the *VR-Forces Users Guide*.
- ♦ The Entity Control Panel is now a floating dialog box, rather than a docked panel that you can choose to float. Also, it is opaque rather than translucent, making it easier to read.

- ♦ In aggregate-level SMSs, you can now specify a default loadout for aircraft entities. Use the star icon in the Combat tab.
- ♦ There are new and updated simulation objects. For a complete list of entities, see the *Entity Model Catalog*. New objects include:
 - Ground vehicles: 2S1 Gvozdika, AZP S-60, GAZ-2975 Tigr-M, GTK Boxer CRV, Kornet D, M1117 Guardian ASV, M1140 HIMARS, M1150 ABV Abrams, M1165A1 HMMWV ECGPV IAP with M240, M1165A1 HMMWV ECGPV IAP with M240B, M1165A1 HMMWV ECGPV IAP with M2, M1165A1 HMMWV ECGPV IAP with MK 19, M1165A1 HMMWV ECGPV IAP, M142 HIMARS ATACMS, M198 Howitzer, M997 HMMWV Ambulance, NASAMS 2 Launcher, SA-15 Command Post (9S737), T-14 Armata, T-15 Armata IFV, T-55 MBT, T-62 MBT, Toyota Land Cruiser M240.
 - Fixed-wing entities: A400M Atlas, A400M Tanker, AC-130U Spooky II, Airbus A310 MRTT Tanker, Airbus 310-304, Airbus 319 - Air China, Boeing 737-900, Boeing 777-200, Boeing 777-300, Boeing 787-800, C-130J Super Hercules, CC-115 Buffalo, CC-150 Polaris, CV-22B Osprey, Cessna 185 Skywagon Floats, Chengdu J-10C, Chengdu J-20, E-8C JSTARS, F-5E Tiger, IAI Heron, IL-76MD Candid B, IL-78M Midas Tanker, JAS 39 Gripen, Jaguar IS, KC-10A Extender, KC-130 Hercules Tanker, KC-130J Super Hercules Tanker, KC-46A Pegasus, L-39 Albatros, MV-22B Osprey, MiG-35 Fulcrum F, P-8A Poseidon, Rafale B, SU-33 Flanker D, SU-35 Flanker E, Shenyang J-15 Flanker D, Xian H-6U Badger Tanker, Xian KJ-2000 Mainring.
 - Rotary-wing entities: AH-7 Westland Lynx, Agusta Westland AW-139, Bell 429 Global Ranger, CH-146 Griffon, EC665 Eurocopter UH Tiger, MH-65 Dolphin.
 - Surface entities: Charles de Gaulle Class Carrier, Fajr Houdong (Tondar) Class, Karel Doorman Class Support Ship (A833), Kuznetsov Class Carrier, Ticonderoga Class Cruiser, Type 45 Daring Class Destroyer.
 - Cultural features: Air Base, Parachuting Cargo Palettes.
 - Lifeforms: UK Soldier L85A2 UGL.
- ♦ The Spider Web tactical graphic now defaults to 12 spokes. You can change the number of spokes when you create the web.
- ♦ The visualization of tank treads now shows them moving at the correct speed based on the velocity of the entity.
- ♦ VR-Forces now shows wheels rotating in conjunction with a vehicle's velocity and also angles the wheels as the vehicle turns.
- ♦ Models with propellers and rotors, such as propeller planes and helicopters, can now be configured to spin up and spin down and have that be visualized.

Simulation Object Editor

- You can now create new models by inheriting from an existing model, rather than simply copying them. See “Inheriting a New Model from an Existing Model” in the Editing Common Parameters chapter in the *VR-Forces Users Guide*.

If you want to restore them to the parent entity’s original settings, use the new Revert to Parent button. See “Reverting an Inherited Object’s Parameters” in the Editing Common Parameters chapter in the *VR-Forces Users Guide*.

- To support inheritance, VR-Forces no longer support multiple entity definitions in one entity file.
- There is a new feature in the SOE that you can access through the Edit menu: Subordinate Functions. These are text-based handles that identify a user-defined role or function that the subordinate performs in that unit. When editing units in the Simulation Object Editor, there is a new Function button in the Unit Composition box that you can use to specify a subordinate’s function in the unit.
- Users can no longer create a true aggregate out of a psuedo (and vice versa). These features were removed.

New and Updated Tasks and Sets

- There is a new condition statement, Do Until Interrupt, that allows you to have an entity perform a task until a condition is reached. See “Do Until Interrupt Statement” in the Plan Concepts chapter in the *VR-Forces Users Guide*.
- Military aircraft have a new set task under Other, Set TACAN Transmitter. The new simulation object, TACAN Ground Station, also has this set task. See “Set TACAN Transmitter” in the Setting the State of Entity-Level Simulation Objects chapter in the *VR-Forces Users Guide*.
- There are new tasks that replace the takeoff and landing tasks for fixed-wing entities which use the new runway aerodrome and runway objects: Fixed-Wing Takeoff On Runway, Fixed-Wing Land At Aerodrome, and Fixed-Wing Land On Runway. See the Movement Tasks for Entity-Level Scenarios chapter in the *VR-Forces Users Guide*. (The old Fixed-Wing Land and Fixed-Wing Takeoff tasks for fixed-wing entities have been hidden from the GUI, but they still work in scenarios built using those tasks.)
- There is a new aircraft movement task, Move to Bullseye Offset, that you can use to send an aircraft to a location relative to a bullseye. See “Move to Bullseye Offset” in the Movement Tasks for Entity-Level Scenarios chapter in the *VR-Forces Users Guide*.
- There is a new task for tanker aircraft, Establish Refueling Station, which causes them to fly a specific pattern and transfer fuel to aircraft performing the Refuel From task. See “Establish Refueling Station” in the Movement Tasks for Entity-Level Scenarios chapter in the *VR-Forces Users Guide*.

- ♦ There is a new task for aircraft, Refuel From, which allows them to refuel from an air tanker that has established a refueling station. See “Refuel From” in the Movement Tasks for Entity-Level Scenarios chapter in the *VR-Forces Users Guide*.
- ♦ There is also a task for tanker aircraft that allows them to replenish their own fuel. See “Internal Transfer of Fuel” in the Embarkation, Wait, Radio, and Other Tasks chapter in the *VR-Forces Users Guide*.
- ♦ There are two new set data requests that publish lighting information for fixed-wing aircraft. See “Aircraft Lighting” and “Tanker Lighting” in the Setting the State of Entity-Level Simulation Objects chapter in the *VR-Forces Users Guide*.
- ♦ The Launch Smoke task now allows you to specify whether the heading is relative to True or Magnetic north.
- ♦ There is a new task for surface and subsurface entities, Patrol Area, that causes those entities to move through a specified area. See “Patrol Area” in the Movement Tasks for Entity-Level Scenarios chapter in the *VR-Forces Users Guide*.

Terrains

- ♦ When you create a 2D Observer View for a terrain that includes 2D View Layers, that view includes the currently specified 2D View Layer.
- ♦ You can now drag and drop an saved observer view (.osrx) file onto the Observer Views Panel to load it.
- ♦ Entities that are near a crater when it forms now fall into the hole.
- ♦ Added support in VR-Forces to map CDB Raster Materials to VR-Forces soil types. See “Configuring the Raster Material Dataset (005-006),” in the Configuring CDB Terrains chapter in the *Adding Content to MAK Applications Reference Manual*.
- ♦ SilverLining stars are now configured using a csv file. For details, see “SilverLining” in the Introduction to VR-Forces chapter of the *VR-Forces Users Guide*.]

Weather

- ♦ Four new weather areas have been added to the Tactical Graphics palette: diamond dust (a ground-level cloud of ice crystals), haze, mist, and smoke. See “Creating Diamond Dust, Haze, Mist, or Smoke” in the *VR-Forces Users Guide*.
- ♦ Air pressure is now included on the Last Clicked Environment Panel.
- ♦ A Lightning Present check box has been added to the weather tactical graphics configuration dialog boxes and to the Weather dialog box. You can use the Lightning Present check box to add lightning effects to weather areas and weather zones. See “Using Weather Tactical Graphics,” and “Editing a Weather Zone's Environment” in the *VR-Forces Users Guide*.
- ♦ The Lightning Present check box replaces the Thunderstorm option that formerly appeared in the Weather page's Cloud Cover list and Apply Environment Condition list.

- ♦ The cloud cover feature, including the Cloud Cover Editor, has been replaced with an improved Atmospheric Conditions table on the Weather page of the Environment Conditions dialog box. In the Atmospheric Conditions table, you can now set cloud type, cloud cover, and atmospheric conditions like wind speed, visibility, and obscurants, at up to 10 different altitudes. See “Setting the Wind Direction, Speed, and Visibility” in the Setting Environment Conditions chapter of the *VR-Forces Users Guide*.
- ♦ You can now specify an altitude when you set air pressure and air temperature in the Environment Conditions dialog box. See “Setting the Air Pressure and Temperature” in the *VR-Forces Users Guide*.
- ♦ You can now set priorities for wind corridors to determine which wind corridor’s conditions prevail when corridors overlap. See “Creating a Wind Corridor” in the *VR-Forces Users Guide*.
- ♦ Two new precipitation types have been added to the Weather page of the Environment Conditions dialog box: sleet and drizzle. See the section “Specifying Precipitation Type and Intensity,” in the *VR-Forces Users Guide*.
- ♦ VR-Forces can now publish most of the object classes and attributes found in the NETN METOC FOM. See “Publishing Weather Over HLA Using NETN METOC FOM” in the Setting Environment Conditions chapter in the *VR-Forces Users Guide*.

GUI

- ♦ You can now specify the push-to-talk button for the MAK Radio standalone application. See “Audio Settings” in the MAK Radio chapter in the *VR-Forces Users Guide*.
- ♦ When you use the search field (it has focus), in either the Simulation Objects or Tactical Graphics Palettes, the panel now remains open and active, regardless of whether you move the mouse away from it.
- ♦ The new observer setting Bullseye Range/Bearing On Pointer shows the bearing and range to the bullseye from the location of the mouse cursor.
- ♦ There is a new compass style when using 3D views. Instead of the round compass at the top right, there is now a horizontal compass across the top that indicates the direction where the observer is looking. This is either true or magnetic north, based on the Heading specified in the Display Units Settings.

Performance and Load Balancing

- ♦ There is a new option in the frame rate monitor, Simulation Objects. This allows you to see how many objects are being simulated on each back-end. See “Monitoring the Back-end Frame Rate” in the Optimizing Performance chapter in the *VR-Forces Users Guide*.
- ♦ A new option in the Selected Simulation Engine Toolbar list, Automatic, is selected by default. When selected, newly created objects in the front-end are placed on the least burdened back-end (based on simulation object loads).

- ♦ You can choose to enable adaptive tick rate to improve performance in scenes with many human characters. The Adaptive Tick Rate check box in the Entity Display Settings controls whether the tick rate for entities adjusts based on their distance from the observer. (There can be display issues with high speed objects, such as aircraft, when adaptive tick rate is enabled.)
- ♦ Performance speed continues to improve.

Configuration and Startup

- ♦ Reverse Z buffering is now enabled by default. As a result, the command line argument for reverse Z changed from `--useReverseZBuffer` to `--disableReverseZBuffer`, allowing you to disable the feature as needed.
- ♦ VR-Forces can now publish most of the object classes and attributes found in the NETN METOC FOM. The METOC FOM module is only supported when using HLA Evolved. To enable the publishing of METOC FOM classes you must:

1. Enable METOC publishing in *vrfSim.mtl* (*.\appData\settings\vrfSim\vrfSim.mtl*). In this file there is a setting called `enableMetoc` which must be set to 1.

2. In the VR-Forces Launcher, either edit the existing HLA Evolved connection or duplicate it and add the NETN-BASE.xml and NETN-METOC.xml FOM modules.

When enabled, the VR-Forces simulation that is responsible for weather simulation publishes the weather state using both its previously existing approach of using an `EnvironmentProcess` with custom records as well as using the METOC FOM object classes. (VR-Forces does not currently support any of the METOC interaction classes.)

- ♦ A new option has been added to the frame rate monitor, Simulation Objects. This allows you to see how many objects are being simulated on each back-end.
- ♦ There is also a new option in the Selected Simulation Engine Toolbar list, Automatic. This is selected by default and, when selected, newly created objects from the front-end will be placed on the least burdened back-end (based on simulation object loads).

API Changes

- ♦ We added more information to the API documentation for writing Simulation Object Editor (SOE) plug-ins. See Section 6.3, “Creating a New Controller” and the Radar Warning (`radarWarnRx`) example in *VR-Forces Developers Guide*.
- ♦ Implemented a set of API functions for querying the weather state along a line. No synchronization locks have been used because the functions do not modify the `DtWeatherStateProvider` class members. The access is read only.

- ♦ The new `receiveObjectMessage()` function is called when the simulation object executing this task receives an object message. The function provides some data to determine what type of object message it is and which simulation object the message came from. See “Script Entry Points” in the *Writing Scripts* chapter of the *VR-Forces Users Guide*.

Documentation

- ♦ The online help, accessed from the Help menu in VR-Forces and the Simulation Object Editor, is now in an HTML format with a more modern look and an improved search utility. The help is built into VR-Forces and the SOE and does not require an internet connection.

Documentation Updates

Documentation has been updated for this release. The guides are provided as PDF files in the `./doc` directory. Online help is available from the VR-Forces Help menu. You can also find the most current PDFs at <https://www.mak.com/support/product-user-guides>. (You must be able to log in to the web site.)

Fixed Bugs

Problems identified in previous releases have been fixed. For a summary, please see the `./doc/FixedDefectsVRF.csv` file.

Known Problems

- ♦ There are a few issues that require you to add the application name to the *BlackApps.dat*:
 - Under certain circumstances, opening VR-Forces on a second display prevents the program from starting.
 - In addition, launching from the main display and then moving the mouse cursor to the other monitor causes the program to freeze and not respond.
 - Sometimes, selecting an SMS to open in the Simulation Object Editor causes the program to hang.

If you experience any of these issues, edit the Nahimic *BlackApps.dat* file and add the application name (for example, `vrfLauncher.exe` or `simulation-ObjectEditor.exe`) to the list. You can search `C:\ProgramData` for *BlackApps.dat* to locate it. This file might be found in `C:\ProgramData\A-Volute\A-Volute.Nahimic\Modules\Scheduled\Configurator`, or `C:\ProgramData\A-Volute\A-Volute.28054DF1F58B4\Modules\ScheduledModules\Configurator`, or something similar.

- ♦ There is a known problem with VR-Forces and CentOS 8 running out of memory. When the OS runs out of memory or starts using the swap memory, it can become unresponsive. Here are some potential solutions:

- Adjust the terrain being loaded in VR-Vantage to have fewer osgEarth layers and simpler models to reduce the memory consumption.
- Add more RAM to your computer.
- Upgrade the Linux kernel to at least version 5.7. We have found that the default kernel of 4.18 becomes unresponsive when the swap is being used but the 5.7 kernel does not have this problem.
- ♦ On Linux machines, when you use the built-in screen capture feature, the screenshot is not adjusted for gamma corrected. It appears dark in the default image viewer on Linux but displays correctly in other applications.
- ♦ Feature indexing for model layers in osgEarth terrains is not supported by VR-Forces and must be disabled on all model layers to avoid performance issues and the possibility of crashes:

```
<model>
  <feature_indexing enabled="false"/> <!-- include this with every model
    section for VR-Vantage. If enabled, feature_indexing causes performance
    issues and crashes on Linux -->
  <!-- rest of model layer setup here-->
</model>
```

