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2020.01-02 [147727] 2019-10-15

## + New Features and Changes

### Subnetwork Generator

- + Handling of DRT path legs: When generating a subnetwork, public transport path legs covered by DRT transport systems are now taken into account, i.e. their demand enters or exits the network at the point where the (imaginary) shortest path in the PrT network enters or exits the subnetwork area. **(20500)**

## ✓ Fixed Bugs

### COM-API

- ✓ Crash at ILink.InMainTurns or ILink.OutMainTurns: No more crash when calling one of the methods InMainTurns or OutMainTurns to output the inbound or outbound main turns of a link if the From- or To-node of the link is not assigned to a main node. **(20607)**
- ✓ ILink.InTurns and OutTurns as well as InMainTurns and OutMainTurns: Until now, the methods ILink.InTurns and ILink.OutTurns returned the wrong result set, i.e. InTurns returned the outbound turns and OutTurns the inbound turns. In the same way, ILink.InMainTurns and OutMainTurns were mixed-up. This bug has been fixed. **(20564 🚫)**

### Network Editor

- ✓ Locations are not re-projected: When changing the co-ordinate system of a network, the co-ordinates of locations were not converted. This error has been fixed. **(20609)**

### PrT Assignment

- ✓ Procedure parameters not correct after switching the assignment procedure: If the procedure variant was switched to 'TRIBUT-Equilibrium assignment' or 'TRIBUT-Equilibrium\_Lohse' in a PrT assignment procedure step and assignment was then started without first opening the parameter dialog for this procedure, assignment could not be executed. This error has been corrected. **(20522)**

### PuT Line Blocking

- ✓ Interruptions of depot stays due to very short loading: In line blocking with recurring actions and depots, unwanted interruptions of the depot stay could occur due to very short loading activities. This effect occurred particularly when the arrival and departure times of the vehicle journey sections were not all full minute values. This error has been fixed. **(20351)**

### Transfers Display of Regular Services

- ✓ Switching the interface language: If the language of the user interface was switched when the display of regular services was open, the input fields for From-time, To-time, basic cycle and tolerance were cleared. This bug has been fixed. **(19016)**

## 🚫 Breaking Changes

### COM-API

- 🚫 ILink.InTurns and OutTurns as well as InMainTurns and OutMainTurns: Until now, the methods ILink.InTurns and ILink.OutTurns returned the wrong result set, i.e. InTurns returned the outbound turns and OutTurns the inbound turns. In the same way, ILink.InMainTurns and OutMainTurns were mixed-up. This bug has been fixed. Scripts that have relied on this error must therefore be adapted to the corrected output. **(20564 ✓)**

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2019-10-09

## + New Features and Changes

### Dialogs

- + Filter for time intervals in attribute selection: In the attribute selection dialog, the filter for restricting the displayed subattribute values for time-dependent attributes has been extended so that it is now also possible to filter for a specified time period. In this case, the subattributes are provided for each time interval that overlaps with the specified period, regardless of the time interval set to which the respective time interval belongs. The belonging to different time interval sets is visible in the attribute tree itself. **(20479)**

### Miscellaneous

- + Presetting for time interval filter in user preferences: Until now, there was an option in the user preferences to set the attribute filter for attributes with a time reference to 'analysis period only' in the attribute selection dialog. In order to also have access to time interval sets, the meaning has been changed to 'Hide analysis horizon', i.e. if this option is activated, the subattribute values for the analysis period and - if available in the network - for time intervals are now visible. **(20478)**

### Network Comparisons

- + Partial changes of node geometries in model transfer files: Previously, node geometries in model transfer files were always completely replaced when one of the involved links was deleted, i.e. the complete node geometry was listed in '!' tables. This meant that different changes to the same node geometry could not be combined in successively imported model transfer files. This error has been fixed. **(20586 !)**

### PrT Assignment

- + Parallelization of network volume: The calculation of network volumes within the framework of all PrT assignment procedures was parallelized. This means that the strongly parallelized procedure variants in particular scale better with the number of cores used. **(20579)**

## ✓ Fixed Bugs

### Add-Ins

- ✓ Error messages of the add-in 'FareZone -> POI' not displayed in the message window: Error messages issued during the execution of the add-in 'FareZone -> POI' were no longer displayed in the message window. This bug has been fixed. **(20517)**

### COM-API

- ✓ Crash when terminating Visum: When terminating a Visum instance started via COM, a non-deterministic crash could occur if certain views in PTV Visum were open, e.g. a schematic line diagram. This bug has been fixed. **(20448)**

### Data Model

- ✓ Access to legs very slowly in large networks: In large networks, access to the legs of nodes and main nodes was unnecessarily slow. As a result, operations such as deleting nodes or main nodes lasted too long, possibly triggered indirectly by importing network or model transfer files. This error has been fixed. **(20502)**
- ✓ Changing the start day of the calendar period leads to error messages: If the start day of the calendar period is changed and time interval sets exist in the network, unauthorized messages occurred for overlapping time intervals within the time interval set. This error has been corrected. **(20575)**
- ✓ Update of the attribute tCur\_PrTSys at connectors: The value of the attribute tCur\_PrTSys at connectors depends on the setting of the calculation method for connector shares of different attributes of the zones, the general procedure parameters as well as the demand itself. Previously, the values were not updated when changes were made to the relevant data. This error has been fixed. The values are still not updated when changing the demand description (selection of the relevant matrices) or the values of the matrices themselves. In PrT assignment, however, updated values are always used for calculation, so that non-updated values are only displayed in lists. **(20425)**

### I/O Interfaces

- ✓ Floating-point numbers in railML export XML-compliant: Until now, the decimal separator specified in the user preferences of PTV Visum was used for floating-point numbers in railML export. In XML, however, only the point is allowed as decimal separator. The output is now in XML correct format, regardless of the user setting. **(20163)**

- ✔ Invalid link orientations after GTFS import: After executing a GTFS import, the From- and To-node orientations of some links were 'invalid'. This error has been fixed. **(20589)**

## Lists

- ✔ Reference object for lists for static ABM objects: In the lists for the static objects activity locations, households and persons of an ABM demand model, the location filter did not adapt when the location selected as the reference object was changed. This error has been corrected. **(20567)**

## Network Comparisons

- ✔ Exchange of main node cordon links via model transfer file: If a model transfer file contains both the removal of cordon links of a main node and the insertion of other links at the same main node, this network change could not be restored correctly in certain constellations when applying the model transfer file. This bug has been fixed. **(20554)**
- ✔ Major flows and node geometries in model transfer files: Certain changes to node geometries and major flows could not be applied when using a model transfer file. This error has been fixed. **(20587)**
- ✔ Merging or separating node legs via a model transfer file: If a model transfer file contains the merging of two links to a node leg or the splitting of a node leg consisting of two opposite one-way streets, this network change could not be performed correctly when applying the model transfer file. This bug has been fixed. **(20553)**

## Other Procedures

- ✔ Matrix disaggregation in the procedure sequence: If the 'Matrix disaggregation' procedure was performed in a procedure sequence and it was not the first procedure in the procedure sequence, the output matrix could contain incorrect values. This bug has been fixed. **(20594)**

## PuT Assignment

- ✔ Crash at timetable-based assignment with passenger trip chains: No more crashes when executing timetable-based assignment with PTV Visum 2020 if there are passenger trip chains in the network. **(20557)**

## PuT Line Blocking

- ✔ Crash during temporal shifting of line block items: No more crash when shifting empty trips or user-defined line block items in the line block display. **(20595)**
- ✔ Crash in case of empty trips between bound vehicle journey sections at the end of a block: If there is a forced chaining where the arriving vehicle journey section ends at a different stop point than the departing vehicle journey section begins, a crash occurred during line blocking if the arriving vehicle journey section was served by the last line block item of a formed block. Otherwise the empty trip item was assigned to a wrong calendar day. Both bugs have been fixed. **(20266)**
- ✔ Transfer layover to depot not possible: In the line block display, it was not possible to transfer a layover to the depot if the display level at which the action was executed comprised more than one calendar day. This error has been fixed. **(20334)**

## Scenario Management

- ✔ Copying and pasting a line route in scenario management: If part of the course of a line route was copied to the clipboard while editing a modification of a scenario management project, it could not be pasted into another line route afterwards. This bug has been fixed. **(20569)**

## Visum Files

- ✔ Endless loop when reading version files: When importing version files that contained main nodes, a situation could occur in which PTV Visum no longer responded and could only be terminated by the operating system (e.g. via task manager). This bug has been fixed. **(20563)**
- ✔ Messages in the context 'Read network' not in message window: Messages that were output in the context of reading a network file were no longer listed in the message window. This bug has been fixed. **(20565)**

## Visum Files, Scenario Management

- ✔ Signal coordination groups cannot be changed via model transfer file: Attributes of signal coordination groups could not be changed by applying a model transfer file. This bug has been fixed. **(20507)**

## ❗ Breaking Changes

## Network Comparisons

- ❗ Partial changes of node geometries in model transfer files: Previously, node geometries in model transfer files were always completely replaced when one of the involved links was deleted, i.e. the complete node geometry was listed in '! tables. This meant that different changes to the same node geometry could not be combined in successively imported model transfer files. This error has been fixed. If newly created model transfer files are imported into earlier Visum versions (up to PTV Visum 2020.01-00), the changes to the node geometries contained therein can no longer be applied in some cases. **(20586 +)**

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## + New Features and Changes

### Scenario Management

- + Default folder for temporary files: The default folder for temporary files, which are created during the distributed calculation of scenarios or procedure steps in the procedure sequence (e.g. before the files are transferred to the compute node), was moved from the user directory to the temporary directory of the system (%TMP%). This means that when temporary files are deleted using the standard Windows procedure, these files are also deleted. **(19041)**

### ANM

- + Export of routes and matrices with rounded demand: When exporting to ANM, the demand can now optionally be rounded. The method used ('Bucket Round') keeps the total demand as constant as possible. In addition to the volumes on the routes, the values of the exported matrices are also consistently rounded. If SBA is used for assignment and rounding to entire vehicles, the simulation paths in particular are retained. **(17406)**

### Add-Ins

- + StreetLight Data: The company StreetLight Data from San Francisco offers OD data for any user-defined zone layers on its website. The add-in enables the retrieval of this data from PTV Visum. It sends the zone layer from the currently loaded version to StreetLight Data and imports the returned OD data as matrices. **(18784)**



### COM-API

- + Besides the continued support for legacy Python 2.7, PTV Visum now brings a Python 3.7 compatible environment. Scripts and Add-Ins started from within Visum can now be written in the Python 3.7 dialect. The Python version to be used can be selected for each script individually, with Python 3.7. being the default for new procedures. For procedures in existing version files, Python 2.7 is used in order to avoid errors in the model runs. Custom script written in the Python 2.x dialect need to be adapted to work in a Python 3.7. environment. The Python libraries installed with PTV Visum are now also provided in recent Python 3.7.x compatible versions. They can be used in external scripts through a venv Python environment. **(19633)**
- + Better messages if the script component fails to start: If the script component cannot be started, e.g. because of a non-existent, unsuitable or incomplete Python installation, the message now provides more information about possible causes. **(9372)**
- + Deleting all LongTermChoices: The new method 'IPerson.RemoveAllLongTermChoices()' allows to delete all long-term choices of all persons in the container. **(20350)**
- + Handling of target attributes during railML import: If there are attributes in the .puti file that do not exist in the target network during railML import, these can optionally be created as user-defined attributes (UDA). When executed via COM, they are always read in as UDAs. **(17922)**
- + IAnalysisTimes no longer exists: The COM object IAnalysisTimes was removed during the conversion of the time interval sets (18222). It is now replaced by the ITimeIntervalSet objects. To establish compatibility, the access function IFunctions.AnalysisTimes still exists, but it returns the ICalendarPeriod, whose interface looks like the previous IAnalysisTimes. However, this access will be removed in the next major version. **(20083 ❗)**
- + Irrelevant classes removed from COM-Reference. The COM-reference listed some classes which are not reachable through API functions. These irrelevant entries have been removed. **(20225)**
- + New method ITableAttrSelection::RemoveColumn: The new method RemoveColumn at the ITableAttrSelection object allows to remove attributes of a table from the selection. If an attribute has subattributes and these are not specified in the parameter of the method, all subattribute values of this attribute are removed from the selection. **(19002)**
- + New method for evaluating formulas on many objects. All network object collections (e.g. ILinks) provide a new method 'GetMultiByFormula()' which evaluates a formula expression for all active objects of the collection. The results are returned as an array similar to 'GetMultiAttValues'. Attribute values remain unchanged. The formula must evaluate to a numeric value, string expressions are not yet supported. **(20121)**

- ⊕ New variant for filtered network object containers: In addition to the 'FilteredBy' property, COM container objects such as ILinks, INodes, etc. now also have a GetFilteredSet method. Both accesses deliver a container object of the same type, but they differ in terms of filter evaluation and performance: FilteredBy evaluates the formula specified as the filter condition at the time when the objects in the container are accessed. However, the container created with GetFilteredSet contains only those objects that make the filter condition true at the time of the call. This variant is significantly faster, especially in nested cases. **(20250)**
- ⊕ Paper size and orientation when printing: When printing using the IGraphic::PrintNetEditor2D method, the paper size and orientation of the print page can now be specified as optional parameters. **(18073 🚫)**
- ⊕ Read and write access to transfer walk times for stop areas: The new property IStop.StopAreaTransferWalkTime allows read or write access to stop area transfer times at the stop. **(17559)**
- ⊕ Remove discontinued methods: The following discontinued methods have been removed from the COM-API: ITimeProfile.Couple, ITimeProfile.Uncouple, IStop.InitSpecialTransferTimes and at the INetReadRouteSearchTSys object the methods DontRead, InsertOrOpenLink, SearchShortestPath, UseExistingLineRouteCourses, DeleteOldLineRoutes and IgnoreItemsWithUnknownNetworkReferences. In the case of the INetReadRouteSearchTSys object, line route completion options are controlled by attributes accessible through the AttValue property. **(17930)**
- ⊕ Setting values of a matrix using a formula: With the new method IMatrix.setValuesToResultOfFormula the values of a matrix can be determined via a matrix-valued formula. There is no context in this formula, and the dimension must match the dimension of the matrix in Visum represented by the IMatrix object. **(17326)**
- ⊕ Switch of the working directory when executing scripts: Previously, when executing a script, the working directory of PTV Visum was switched to the folder in which the script code could be found. Depending on the settings of the project directories, this also affected the subsequent loading of files. This switch no longer takes place, i.e. the set project directories remain untouched in any case. **(19437 🚫)**
- ⊕ Visum now registers a virtual Python environment named 'PTV Visum 2020' suited for the venv tool. This facilitates to reference the Python libraries installed with Visum in external scripts or in development tools (IDEs). The SysPath module so far provided for this purpose is still available, but in most cases it is no longer necessary to include this with the custom script code. Many modern Python-IDEs provide integrated support for virtual environments and allow to select the environment registered by Visum for script development and execution. **(20134)**
- ⊕ Writing a list using a layout file: Using the new method IIO.SaveAttributeFile, an attribute file can be written using a specified layout file without first having to create the appropriate list COM object. The type of the list to be exported is taken from the layout file. **(17822)**
- ⊕ venv compatibility: The subfolder 'Python37Modules' in the exe directory of the installation has been converted to a venv-compatible virtual environment. **(19953)**

## Data Model

- ⊕ Demand segment set at the demand stratum: At the demand stratum, the demand segments, in which the demand of this stratum enters, can now be modelled in a new attribute. This information is currently not used in the program, but will be used in the future to create a procedure sequence for a demand model. **(19046)**
- ⊕ Internal memory limit for matrices: The internal memory for managing matrix data has been limited. This means that after initializing or deleting matrices, memory space is returned to the operating system earlier and does not remain reserved, and procedures with very high memory requirements are more likely to run through. **(19684)**
- ⊕ Line Block Items: The attribute 'StartDayIndex' does not refer to the start of the calendar, but to the start of the line blocking period. Therefore, it has been renamed 'RelativeStartDayIndex'. The Attribute that refers to the start of the calendar is called 'AbsoluteStartDayIndex'. Similarly, 'EndDayIndex' becomes 'RelativeEndDayIndex'. **(20122)**
- ⊕ New network setting for handling of length information in PT: When activating this option, length information of line and system routes are automatically adjusted to the link attribute 'Length'. **(18620)**
- ⊕ New relation from link to vehicle journey items: The new relation from link refers to all vehicle journey items passing over the link. **(19796)**
- ⊕ New relation from node to stop: A new relation from node to stop has been added. The relation from the node refers to stops whose stop points are either located on the node or whose stop areas are connected to the node. **(18805)**
- ⊕ New relation: The relations between path sets and network have been added. **(20216)**
- ⊕ New relations between nodes and zones: There are new relations between nodes and zones showing containing zones and contained nodes, respectively. **(18799)**
- ⊕ Normalization and harmonization of surfaces: The network setting for number of decimal places for coordinates is no longer used when normalizing and harmonizing surfaces. To achieve desired effects when harmonizing surfaces the parameter can be set in the dialog when reading data. **(10140)**
- ⊕ Relation of PuT paths to all path legs including walk legs: The previous relation from PuT paths to their PuT path legs only lists path legs with transport, i.e. no path legs covered with PuT-Walk transport systems. For this purpose a new relation 'PuT path legs including walk legs' was created, which lists all PuT path legs. The previous relation has been renamed to 'PuT path legs excluding walk legs' for clarification (with the short name remaining for PTV Visum 18). **(19919)**

- + Relation of vehicle journey item to all serving vehicle journey sections: In addition to the existing relation of vehicle journey items to vehicle journey sections, which lists the vehicle journey sections operating on the following stop-stop section, there is now an additional relation, which lists all vehicle journey sections serving the stop itself, i.e. also those ending there. **(19577)**
- + Relations from network to demand objects: The relations from network to demand objects have been added. **(20323)**
- + UDA with user-defined time intervals: User-defined attributes can be created with any time intervals. To do this, the subattribute must be selected from the existing time interval sets. **(19937)**
- + User-defined attributes for signal coordination groups: Signal coordination groups can now also have user-defined attributes (data and formulas). **(16938)**
- + User-defined time interval sets: It is possible to define multiple time interval sets. The time intervals within one set may vary in duration, but cannot overlap. The time interval sets are network objects and are no longer available in the General procedure settings. Only one time interval set can be used for analysis time intervals. **(18222)** 
- + Changed default value for empty values of user-defined attributes: the default value for the property 'Allow empty values' was changed to 'false'. Thus, new user-defined attributes don't allow empty values if the setting remains unchanged. **(10302)** 
- + More zone types: The attribute 'Type no' of zones now accepts values up to 100 instead of only 9 before. This allows use more combinations of zone types for defining demand time series. **(19017)**
- + Preservation of chainings when changing calendars: When switching between calendar types e.g. from yearly to 'no calendar' during imports of railML data, all vehicle journey chainings got lost. This was changed and chainings are now preserved where possible. **(20148)**

## Demand Procedures

- + Coupling across demand strata in EVA demand models: Until now, EVA demand models carry out origin- and destination-bound binding for each demand strata separately. Now, the binding can be coupled among all demand strata of an activity pair. **(18305)**
- + Create procedure sequence: When creating a procedure sequence from the demand model dialog (Tab: Basis) the allocation of demand strata to demand segment sets is considered. **(19047)**
- + Creating tours with the tour-based model: When executing the procedure 'Tour-based model - Combined trip distribution / mode choice', it is now possible to optionally output path sequences, which result from random dicing of the zone transfers according to the transfer probabilities calculated in the tour-based model and thus represent the result of the distribution and mode choice in an exemplary manner. **(17408)**
- + Gaps from the Nested Demand model in protocol file: The Gap calculated by the procedure 'Nested Demand Gap Calculation' is now reported in the protocol file. Thereby, the progression of Gap values in iterative procedure sequences can be observed. **(20377)**
- + Generation of path sequence activities when issuing path sequences in the tour-based model: If the generation of path sequences is activated in the 'Tour-based model - Combined trip distribution / mode choice' procedure, any missing path sequence activities are created automatically. These then refer to the respective activity in the demand model. **(19516)**
- + Incremental model form: The constraint type 'doubly-constrained' is now also available in the incremental model form. **(19394)**
- + Less run time and memory consumption of 'Nested Demand': The run time and memory consumption of the 'Nested Demand' procedure was reduced, especially in the case of 'doubly-constrained'. **(20233)**
- + Microscopic demand modelling (ABM): The new ABM modul stands for activity-based model and allows building a microscopic demand model based on individual decisions of individual persons. The implementation comprises the data structures (persons, activity executions, tours, ...) and visualisation tools. The model core including the decision models is scripted by the user. An example of such a script is part of the release. **(19656)**
- + Tour-based distribution/mode choice no longer executable in case of contradictory information on path sequences: The 'Tour-based model - Combined trip distribution / mode choice' procedure now explicitly terminates with an error if the generation of path sequences is required but no valid path sequence set is selected. In addition, the parameter dialog has been improved in details. **(19515)**

## Dialogs

- + Allocation of stops to fare zones: The allocation of stops to fare zones can additionally be done using the Search-Dialog. **(18624)**
- + Demand model dialog with list grids: In the demand model dialog some tabs, e.g. demand strata, are changed to list grids, i.e. typical functionality like group column is available. **(19223)**
- + Different structure of 'large' attribute selection dialog: In the 'large' attribute selection dialog, which allows not only the selection but also the formatting of columns, the attribute selection and the formatting options are no longer arranged one below the other, but next to each other. **(7406)**
- + Improvements to the 'Alias' dialog: In the 'Alias' dialog, the inputs already defined by the call context are now only displayed as labels. In addition, the first control that requires an input gets the focus after opening the dialog. **(17694)**

- + In many places of the user interface, long lists for selecting objects (e.g. lines, line routes,...) have been replaced by a new interactive search control. **(19136)**
- + Line Route Editor: Selected line route elements in the line route editor can be copied and pasted into another line route. This also works between version files. If several travel time profiles are available in the source or destination, the user can match those. **(18529)**
- + More modern attribute selection dialogs: Both attribute selection dialogs have been modernized. The 'small' version, which only allows the selection of one attribute, now appears as an input field with the possibility to search for attributes by name components. The 'large' version, which offers a range of attributes including formatting options, also allows a search, but also multiple editing of formatting options. **(18343)**
- + Move and duplicate filter conditions: Filter conditions can be duplicated as block. The entire block is then inserted under the selected filter conditions. Additionally, new buttons in the dialog allow to move filter conditions up or down. **(18606)**
- + Name suggestion for 'Copy line': When copying a line, the previous name of the line is now offered as default (which of course has to be changed), analogous to line routes. **(18137)**
- + Network check: The model dialog for the network check has been changed to a tool window. Therefore, network checks can be executed while this tool window can be open. **(19177)**
- + Optimum table width by double-clicking on the separator in the line route editor: In the line route editor, the position of the separator can be adjusted to the current width of the left table with a double-click. **(17566)**
- + Search in graphic parameter dialog for line bars: In the graphic parameter dialog for line bars, on the dialog page 'Fill', you can now search in the (possibly very long) list of network objects. To do this, open the search dialog by clicking a new button and then search for the appropriate network object based on any attribute value. **(18793)**
- + Vehicle units and combinations: The dialog for editing vehicles and vehicle combinations has been modernized. **(19667)**

## Filters

- + Move and duplicate filter conditions: Filter conditions can be duplicated as block. The entire block is then inserted under the selected filter conditions. Additionally, new buttons in the dialog allow to move filter conditions up or down. **(18606)**

## Foreign Formats

- + Handling of target attributes during railML import: If there are attributes in the .puti file that do not exist in the target network during railML import, these can optionally be created as user-defined attributes (UDA). When executed via COM, they are always read in as UDAs. **(17922)**

## Formulas

- + Acceleration for matrix variables: The formula function matrix sum has been accelerated for the use of matrix variables (e.g. M for matrix). **(20437)**
- + Control variable of a TableLookup via matrices in formulas: If a TableLookup statement whose control variable is a matrix was used in a formula, this control variable could not be used in a part of the expression to be evaluated for the control variable that expected a matrix, such as in the formula 'TableLookup(MATRIX M, M[NO]=[NO], MATRIXSUM(M))'. This bug has been fixed. **(19387)**
- + Editing formulas in lists: Formulas of attributes or matrices can easily be edited via the button '...' which opens the formula editor. **(19545)**
- + Help in subdialogs of the formula dialog: The subdialogs accessible from the formula dialog, e.g. for inserting operators, operands and functions, now offer a context-sensitive help that can be opened by pressing the F1 function key. **(19608)**
- + In formula attributes, new functions now also allow the use of terms that access matrices via aggregate functions, for example the total sum of a matrix. Conversely, scalar-valued terms can also be used in formula matrices, which in turn are derived from matrices via aggregate functions. **(12544)**
- + Naming of functions in the formula dialog: In the dialog 'Insert function', which can be reached from the formula dialog, the names of the available functions have been improved. **(19028)**
- + Output of control variables in ForEach: If a loop is used in the 'Combination of matrices and vectors' procedure using the 'ForEach' instruction, in the dialog, the system now displays which matrices would be changed when the current formula was executed and which would be newly created. When the procedure is actually executed, the changed and newly created matrices are logged (in the message window and log file). **(19212)**

## Formulas, Demand Procedures

- + Acceleration of the evaluation of matrix formulas: The evaluation of matrix formulas was accelerated, especially for large networks. This also has a positive effect on the duration of the 'Tour-based model - Combined trip distribution / mode choice' procedure. **(17602)**

## Graphical Procedures

- + DRT in flow bundle and skims: In the PuT flow bundle, conditions for nodes and links can now also be set for PrT transport systems in order to be able to distinguish the volume of DRT (MaaS) systems from line and walk transport systems. Furthermore, the new skims 'DRT distance' and 'DRT time' can be calculated as skim matrices. **(18028)**
- + Dynamic shortest path search for SBA: The interactive PrT shortest path search has been enhanced for SBA, i.e. a dynamic search is possible by specifying a departure time. **(18413)**

## Graphics

- + Charts with classified colors: Up to now it was only possible to define the size of a pie chart or a column chart by an attribute value. Now the color of each chart element can additionally be classified by an attribute value. For example, a pie chart scaled by the number of passengers alighting and coloured by the average risk of delay. **(18299)**
- + Connect bar polygons: Connecting link bars often led to misrepresentations at junctions with multiple legs or unusual geometries. The methods for calculating bar polygons has been improved. The option 'Connect bar polygons' has been removed. The link bars are now always connected. **(12784)**
- + Opening files after graphical export: After a graphical export (screenshot, SVG export) the resulting file is opened immediately. **(18926)**
- + The default value of the 3D graphics interface has been changed from OpenGL 3.0 to DirectX 11. **(18987)**
- + Units in tables: Units can optionally be displayed for tables that contain attribute values with units. **(19057)**

## I/O Interfaces

- + Acceleration of database export: Export to a database has been significantly accelerated. This acceleration depends on the database and the ODBC driver supporting the new procedure. This is at least the case for MS SQL Server with the latest driver. If the requirements are not fulfilled, the previous, slower variant is used. **(18526)**
- + Aggregating optional with GTFS: When importing a General Transit Feed (GTFS), aggregating the resulting line routes is now optional. **(19096)**
- + Aggregation of line routes accelerated: The aggregation of line routes has been accelerated for many constellations. This applies both to the special function in the network editor and especially to aggregation in the context of the GTFS import. **(19097)**
- + Attributes from operationalTrains in railML import: Attributes from operationalTrain can be imported and allocated to attributes of vehicle journeys. **(19013)**
- + Code of the stop point in railML export: The code of the stop point is additionally used to create the OCP-ID. **(18808)**
- + Intersection data import: External intersection data can be imported into an existing Visum model. Precondition is that the data are available in a specified format consisting of several .csv files that enables mapping of geometry data and adding information about signalization. **(19640)**
- + Link stop points traversed multiple times when updating PuT supply: When importing a PuT supply from Visum, undirected link stops were traversed multiple times at the beginning or end of line routes, where the line route initially leads in the wrong direction to the end of the link and turns there. This is now avoided by an improved routing at both ends of a line route. **(18934)**
- + Not uniquely assigned ocp at the beginning or end of a trainPart in railML import: If a trainPart element starts or ends at an ocp that is not or not uniquely allocated to a stop point in the Visum network, this trainPart could not be read in during railML import. This case is now handled by using the nearest ocp for ambiguously assigned ocp. If an ocp is not located in the target network at all, the trainPart (and thus the resulting vehicle journey) is shortened to the next allocated ocp with a stop. A trainPart is therefore only completely omitted in very rare cases, e.g. if there is not any clearly allocated ocp in the route course. **(18326)**
- + OSM import: The progress bar shows the actual status as well as the steps of the import. **(16544)**
- + PuT Supply from Visum: When using the import of PuT supply from Visum intermediate points can be omitted if these points prevent matching to the target network. **(18660)**
- + Sequence of name components for railML and HAFAS import: In the parameter dialogs of the railML and HAFAS dialogs, the sequence of the name components in the naming rules for vehicle journeys, lines, destination coaches, etc. can now be changed subsequently without having to deselect and re-select the components in the correct sequence. **(18605)**
- + Special codings of couplings in railML import: The railML import reads data in which the same 'trainPart' is used in two 'commercial trains'. **(18809)**
- + Standards-compliant GTFS export: The GTFS export now always delivers a fully standards-compliant file. **(16529)**
- + Parameters in SATURN input files: The SATURN import now accepts parameters spanning multiple lines in the SATURN data file **(20510)**

## IO Interfaces



- + Warnings for skipped data in VDV452-Import: The VDV452 import skips records with unmatching Base version number. When rows are skipped, this is now reported in the messages in order to indicate possible inconsistencies in the source data. **(20271)**


## Installation

- + Diagnostics program: Diagnostics for PTV Visum has been integrated in the Setup. **(15973)**
- + Russian manual: The installation now also contains a manual in Russian, but it refers to an older version (PTV Visum 15). **(19354)**
- + Safety and importers in demo version: In the demo version, you can now also use the Safety module and various importers, e.g. for OpenStreetMap. **(16207)**
- + The Silent-Installation does now also install the the Python packages automatically. **(19393)**
- + Update Python Engine: The Python installation distributed with PTV Visum has been updated to version 2.7.15. This also includes the package management system pip. **(18424)**

## Junction Editor

- + Save / open layout: The junction editor layout can now be saved and read explicitly via a menu entry. **(13232)**
- + Vissim previewer updated: The Vissim version used for the node preview has been updated to PTV Vissim 11.00-03. **(19442)**
- + Vissim-Preview: The Vissim-Previewer is using PTV Vissim 11. **(18800)**
- + Vissim-Preview: The Vissim-Previewer is using PTV Vissim 2020. **(20295)**

## Line blocking

- + Runtime improvement: The run time of the line blocking procedure has been improved, specifically when recurring activities are considered **(20392)** 

## Lists

- + 'Irrelevant' marker in the demand model: In lists for the network objects of the demand model (demand models, demand strata, person groups, activities, activity pairs, sectors and delivery concepts), attributes are now marked as irrelevant if they are not included in the calculation in the demand model used because of its type or because of other properties (e.g. O-D type of the demand stratum, etc.). **(19015)**
- + Attributes list improved: The usability of the Attributes list has been improved in some respects. **(19053)**
- + Column filter in attribute list: The column filter on the column 'ObjTypeName' has been improved in the 'Attributes' list. In particular, only those entries can be selected that are displayed in the list according to the set global filter (i.e. 'All attributes', 'Only network object types' or 'Only user-defined'). **(19124)**
- + Copy column as user-defined attribute: It is now possible to copy the contents of a column in a list to a user-defined attribute using an entry in the shortcut menu of the header of a column. In detail, this means that a user-defined attribute of the appropriate type is created for the same network object, the values of the selected column are copied there, and the new attribute is displayed as a column in the list. **(16813)**
- + Drag & drop for list layouts: If layouts of lists (.lla files) are moved to the Visum GUI using drag & drop, the list is automatically opened with the corresponding list layout. **(18572)**
- + Editing formulas in lists: Formulas of attributes or matrices can easily be edited via the button '...' which opens the formula editor. **(19545)**
- + Improved usability for color schemes: The usability of the settings for color schemes in lists has been improved. In particular, the dialog for the operation 'Specify color scheme for all columns...' is already initialized with the existing classification if the columns already have a uniform classification. **(17179)**
- + List PuT transfer objects: The list PuT transfer objects contains an additional filter condition for 'Operators'. **(19747)**
- + Loading of the list 'Passengers transfer stops / time profiles' faster: The build-up of the list 'Passengers transfer stops / time profiles' was accelerated. **(18950)**
- + Local filters for columns: In lists, the contents can be filtered according to attribute values in individual columns. This local filter is independent of the global filter for the network object and only works in the list, possibly in addition to other filters in the same list, for example 'Only active objects'. **(18015)**
- + Marking of ABM objects: Markings are now synchronized between different related objects of the ABM data model. For example, marking of a person will also mark the related schedules in lists when synchronization is activated. **(20056)**
- + Restrict lists of ABM objects by reference objects: The rows displayed in listings for ABM objects can now be restricted by a selection of related reference objects (locations or persons). **(20031)**
- + Settings for connecting journeys: The network settings for connecting journeys can be accessed and edited from the list Connecting journeys. **(18571)**


## Lists, Matrix Editor, Procedure Sequence

- + Horizontal scrolling with direct movement: Previously, when scrolling vertically in longer lists, the view was moved directly so that new rows were added to the visible area, whereas when scrolling horizontally, the view was not updated until the mouse was released. This behavior has now been changed so that the visible area is immediately adjusted in both directions. This makes it easier, for example, to find the desired column in a list with many columns. This new behavior works in all list-like views, for example in the procedure sequence window and in the matrix editor. **(20139)**

## Main Window

- + Default aggregation functions in Quick view: In the Quick view, the 'Compare' aggregation function has always been used by default for editable attributes, even if other aggregation functions were more useful from a content perspective. Now the aggregation functions 'Compare', 'Distinct', and 'Histogram' are offered depending on the specific attribute. With these aggregation functions, it remains visible if several attribute values are involved when several objects are selected. **(19376)**
- + Hot key F7: The shortcut F7 can be used to trigger the aggregation of territories. **(17455)**
- + Project directories on the start page: Project directory files from the history of recently opened files are now also displayed on the start page. **(18406)**
- + Repairing individual messages: Added the ability to repair individual messages for the network check function 'Find line and system routes with zigzags'. **(20315)**

## Matrix Editor

- + More stable calculation for matrix and row sums: The calculation of matrix and row sums in the Matrix Editor has been improved. Only interactive editing in the Matrix Editor can cause small inaccuracies. **(20436** 

## Matrix Estimation

- + Dynamic matrix estimation for PT: The procedure for dynamic matrix estimation has been extended for public transport. Matrices of demand segments assigned using the timetable-based assignment can be corrected. **(19106)**
- + Preview of the shares even with a classified matrix: In the parameters dialog of the 'Demand matrix correction' procedure, the shares of the individual classes are now displayed in the table on the 'Distribution' dialog page, even if they were not entered directly, but result from the corresponding classification of the existing or selected matrix. **(19525)**
- + Progress dialog for large flow matrices: Since flow matrices can become very large, especially in dynamic matrix estimation, and the generation takes correspondingly long, a progress dialog is displayed in this case which also allows aborting. **(20421)**

## Miscellaneous

- + Default option for antialiasing: The option for antialiasing in the user preferences is by default enabled. This results in an improved display in the 3D view. **(20069)**
- + The languages offered for the user interface are no longer controlled through the license. All available languages can be selected, independent of the license. The completeness of the translations cannot be guaranteed for all languages; thus, some elements might appear in the fallback language u'-'; usually English. Online help, manuals etc. are still provided in a subset of the supported languages. **(20137)**

## Network Comparisons

- + Load paths: There is a new option 'Load paths' when creating a version comparison. Loading paths allows to evaluate volumes in the comparison network if in the loaded version a filter on network volumes is applied. **(16091)**
- + Update of version comparison: If for the version comparison a version in the background is loaded and this version has been changed, the target network can be updated to account for these changes. The information is displayed in a message bar. **(19018)**
- + Warning for version comparison with OD pair filter: If an OD pair filter with the option 'Filter network volumes' is active in the currently loaded network, the filtered volumes of a comparison network are always 0 in the version comparison, because the paths of a comparison network are never loaded. In this case, warnings are now issued when you create a version comparison indicating this fact. **(19664)**


## Network Editor

- + Aggregation of line routes accelerated: The aggregation of line routes has been accelerated for many constellations. This applies both to the special function in the network editor and especially to aggregation in the context of the GTFIS import. **(19097)**
- + Changing background maps: Showing and hiding different background maps is now also possible directly via the toolbar of the network editor. **(18831)**






- + Conversion of percentage time series to matrix time series: A new function in the 'Demand data' dialog, page 'Demand time series', can be used to convert a demand time series based on a standard time series into a matrix time series. This is particularly necessary as preparation before generating a subnetwork with a dynamic assignment result (SBA or timetable-based). **(18789)**
- + Display of direction. The display of the direction of lines and line routes, respectively, has been improved. **(18141)**
- + Display of path sequence items: The network editor has been modified to display (and in particular label) selected path sequence items with the same origin and destination zone graphically. **(19209)**
- + Edit polygons without normalizing: When editing polygons (surfaces and faces of polygonal network objects such as zones, territories, POIs), the normalization of the surface data model is no longer carried out for each change, but only if the change has resulted in a new overlap of edges. This makes processing in networks with complex polygons much smoother. **(18806)**
- + Finding routing errors of line and system routes: The checking of line and system routes on links traversed several times has been enhanced. The result now distinguishes zigzag routings, which are usually the result of digitalization errors, from links that have been traversed several times, but not immediately one after the other, as they can also occur in reality with loops in the route course. Repair functions are available for zigzag routings, especially for the case where the served stops can be maintained in their order ('trivial zigzag routing'). **(17457)**
- + Internet map requests no longer block: In certain cases, unanswered requests to the server of an Internet map service could freeze Visum. This is now avoided by completely decoupling the requests, i.e. you do not see the Internet map as long as the server does not answer, but you can continue working in Visum. **(13620)**
- + Length and duration of inserted system routes: When manually inserting a system route, its duration and length are now set to the totaled run times or lengths of the links traversed (instead of to the value 0 as before). **(18736)**
- + SSL/TLS encryption for WMS services for background maps: SSL/TLS encryption is now supported when integrating WMS services for displaying background maps. **(19504)**
- + Special functions: Up to now, special functions in the network editor could only be executed for one object, all active objects, and all objects. In addition, it is now possible to execute special functions for all special functions also on manually set selections. **(10538)**
- + Switching between Edit and Insert mode: If you press the 'Insert' key repeatedly, the network editor toggles between the Edit and the Insert mode. **(18014)**
- + a new function allows to shorten active line routes to the maximum extent of the corresponding vehicle journeys. Unused line route items at the beginning and end of the line routes are removed. **(18619)**
- + Projection for background maps: The option to adjust the network projection to the background map projection is no longer provided when the background maps are activated in order to reduce clicks. The adjustment can now quickly be triggered by a new button in the graphics parameters. Using a projection matching the background map will slightly speedup the loading of the background tiles, but at the cost of using different coordinates for the network objects. **(16569)**

## Other Procedures

- + 'Combination of matrices and vectors' with a lot of matrices: The 'Combination of matrices and vectors' procedure was accelerated in networks with a large number of matrices. **(18940)**
- + DRT in flow bundle and skims: In the PuT flow bundle, conditions for nodes and links can now also be set for PrT transport systems in order to be able to distinguish the volume of DRT (MaaS) systems from line and walk transport systems. Furthermore, the new skims 'DRT distance' and 'DRT time' can be calculated as skim matrices. **(18028)**
- + Improved support for combining matrices and vectors: The parameters dialog of the procedure 'Combination of matrices and vectors' provides the user with better assistance. In particular, there is now a direct reference to the online help with additional examples and explanations as well as a preview of the matrices that will probably be changed or created during the execution of the procedure step. **(19340)**
- + Minimization of fleet size in tour planning (MaaS): If the 'Use dispatcher' option is used in the 'Tour planning' (MaaS) procedure, a new parameter can be used to explicitly control the consideration between the most complete possible service of the trip requests on the one hand and the smallest possible number of vehicles used on the other. **(19436)**
- + More network object types in the 'Edit attribute' procedure: The 'Edit attribute' procedure can now also be used for the following network object types: Activities, activity chains, activity pairs, operators, sectors, ticket types, operating periods, vehicle units, vehicle combinations, vacation days, delivery concepts, matrices, modes, demand models, demand strata, demand segments, main lines, person groups, structural properties, fare systems, fare zones, block items, block item types, transport systems, valid days, path sequence activities, path sequence sets. **(19342)**
- + Selection of the procedure variant for MaaS tour planning: In the dialog of the 'Tour planning' (MaaS) procedure, you can now switch between the 'Use xTour' and 'Use dispatcher' options for the actual optimization. **(18889)**
- + Signal offset optimization: A new version of the solution method has been added for the 'Signal offset optimization' procedure. This may change the results of the procedure. **(18869)**
- + Speed up of matrix operations: Matrix operations have been accelerated. This concerns in particular the procedures matrix aggregation and disaggregation and affects networks with many zones. **(20173)**

- + Tenant selection for PTV MaaS Modeller: If a PTV MaaS Modeller user belongs to several tenants, the tenant to be used for the calculation run started from the Visum procedure sequence can now be selected in the Visum MaaS Modeller license dialog. **(18475)**
- + The progress of the cloud-based MaaS-Tourplanning using the Dispatcher algorithm is now reported. **(19972)**
- + Tour planning (DRT / MaaS): The 'Tour planning' procedure now uses the dispatcher algorithm by default. **(20070)**
- + Tour planning without skim matrices for PrT-DSEg: The 'Tour planning' procedure can now also be executed without skim matrices of the journey time and journey distance being available for the PrT demand segment selected for the vehicle fleet if the dispatcher algorithm is used. Export to PTV MaaS Modeller is also possible in this case. **(19928)**
- + Tour planning: The execution of Tour planning is optionally possible on the local computer. To use it, you must be logged in to the MaaSModeller and have a credit balance. A credit will be deducted if you use it. The cloud-based calculation is still possible. **(20251)**
- + Calculation of emissions with HBEFA temporarily disabled: In the course of updating to the new version HBEFA 4.1 which was released in September 2019, the calculation of emissions is temporarily completely disabled - even for older versions of HBEFA. PTV Visum 2020 will exclusively support HBEFA 4.1 for the calculation of emissions. Due to the various changes in HBEFA, existing procedure parameters and model data need to be adjusted and results will differ from previous versions. The functionality will be enabled again in an early ServicePack expected for autumn 2019. **(20531)** 

## PrT Assignment

- + Acceleration Frank-Wolfe in large networks: The PrT equilibrium assignment Bi-conjugate Frank-Wolfe was accelerated especially in networks with a lot of zones. **(20257)**
- + Base load in SBA: A base load can be optionally taken into account in SBA. The base load can vary within the assignment time interval and requires the allocation of a transport system with meaningful SBA parameters for the effective vehicle length and reaction time defined. **(15540)**
- + Customizable Contraction Hierarchies (CHH): The shortest path search has been speed up using the technique called CHH for the PrT assignment methods Incremental, Equilibrium, BFW, Lohse, SBA, Stochastic and dynamic stochastic. **(18681)**
- + Effect of SC daily schedules in SBA: In simulation-based dynamic assignment (SBA), daily schedules of signal controls in the assignment time interval are taken into account. More precisely: For a signal control of the type Vissig, a daily schedule can be selected via an attribute, which then takes effect. For RBC controls, a daily schedule coded in it always takes effect if it exists, otherwise the set signal program takes effect continuously. **(16497)** 
- + Evaluation of VD functions: The evaluation of VD functions that depend on more than one single attribute has been accelerated. **(19716)**
- + Export from SBA for visualization: During simulation-based dynamic assignment (SBA), vehicle trajectories can be exported for external visualization. **(18777)**
- + Extended factors for reaction times in SBA: With the help of the Boolean link attribute 'SBA is reaction time factor transport system dependent' the factors for the SBA reaction time can be defined depending on the combination of the transport systems of a vehicle and the vehicle in front. This way, the driving behaviour of autonomous vehicles can be mapped in SBA. **(19489)**
- + ICA calculation for Two-way stops: The type of site, i.e. 2-lanes, 4-lanes, or 6-lanes, is now determined by the major flow approach with the larger number of through lanes. For example, if that approach has two through lanes, the site is treated as 4-lane-site, even if the other major flow approach is an outbound one-way street. **(20390)** 
- + SBA Number of paths: The SBA assignment parameters contain a new parameter that defines the minimum volume of a path. Using the default value the number of paths can be reduced considerably but the parameter also has an influence on convergence. **(20089)**
- + Skim matrix calculation for impedance in the stochastic assignment: It is possible to calculate a skim matrix for the total impedance with in the stochastic assignment. This skim matrix contains components of the impedance defined over the entire path. **(17670)** 
- + Speed up of path-based assignments with MPA: The aggregation of path trees has been multithreaded which speeds up assignments with MPA. **(13669)**
- + Speed-up: The evaluation of volume-delay functions has been accelerated. The shortest path search within the classical equilibrium and the incremental assignment, respectively, has been multithreaded. **(16995)** 
- + Temporary closures in SBA: Temporary closures of a link that are modeled using a temporary value of the transport system set attribute are now taken into account in simulation-based dynamic assignment (SBA). **(19004)** 
- + User-defined volume-delay functions (VDF): The creation of user-defined VDF has been simplified and allows further attributes to be considered. **(20312)**

## Procedure Sequence

- + Default folder for temporary files: The default folder for temporary files, which are created during the distributed calculation of scenarios or procedure steps in the procedure sequence (e.g. before the files are transferred to the compute node), was moved from the user directory to the temporary directory of the system (%TMP%). This means that when temporary files are deleted using the standard Windows procedure, these files are also deleted. **(19041)**

- + Display and deleting of groups: By selecting the grouping element in the process dialog, the associated process steps are highlighted. The row of the grouping element differs from the subordinate procedural steps in all columns. The simultaneous deletion of groups and procedures has been made possible. **(12770)**
- + Use of variables: To make the use of variables more transparent, the result message of the procedure in which the variable has been used and the output to the message window have been improved. **(18840)**
- + Executing the entire procedure sequence on a compute node: Within the framework of distributed computing, it is now possible to execute the entire procedure sequence of a version file on a compute node, in particular also outside scenario management. **(13038)**

## PuT Assignment

- + Acceleration for PuT walk links: The management of PuT walk links has been accelerated. **(18670)**
- + Acceleration of the Branch&Bound search: The timetable-based assignment in the Branch&Bound search variant was slightly accelerated. The extent of acceleration depends on the nature of the individual network. **(17442)**
- + Demand Responsive Transit DRT: In order to evaluate the feeder function of ride-sharing systems (first & last mile concepts), the timetable-based assignment brings together the modes of conventional public transport and ride-sharing systems. Within an assignment, the transfer process is depicted, and the temporal and spatial consistency is considered. The results are intermodal connections including the passenger volume. **(20380)**
- + Distributed computing of the PuT assignment: The timetable-based assignment can be distributed to several computation nodes. The results must be merged in a subsequent procedure. **(17435)**
- + Faster headway-based assignment: The headway-based assignment has been slightly accelerated. **(14956)**
- + Holding areas in tour planning: In the 'Tour planning' procedure, selected nodes can now be used as preferred holding areas for MaaS vehicles. If this option is activated, these holding areas are frequented by the vehicles in phases of inactivity. **(19888)**
- + Round volumes: Rounding of volumes within a capacity restricted PT assignment, i.e. also when vehicle sharing systems are considered, is suppressed because it has a negative effect on convergence. In the last iteration the volumes of the connection are rounded. **(19399)**
- + Rounding of demand and passenger volumes: Rounding of demand and passenger volumes have been improved for the PuT assignment. It can be rounded using decimal places or multiple of a pre-defined number. **(18432)**
- + Skim impedance Log Sum: For the timetable-based assignment the skim matrix "Impedance Log Sum" can be computed. This option is available only if the choice model is "Logit". **(13682)**
- + The volumes of PuT paths can now be reported per time interval. The demand from the demand time series intervals is allocated to the respective analysis time intervals. The behaviour is controlled through the option 'Save path volumes per time intervals' in the general procedure settings. Due to the memory consumption, by default volumes are not stored per time interval. **(20168)**

## PuT Line Blocking

- + Active line block version: The option to set one line block version active has been removed. The line block version can be defined directly in the procedure 'PuT operating indicators'. **(2605)**
- + Layover in depot as block item type: Previously, individual block item types of the category 'Layover' could be flagged as taking place in the depot using an attribute. Other cost rates then apply in line blocking. This attribute 'In depot' no longer exists. Instead, there is a separate system-defined block item type 'Layover in depot', which marks a block item as a layover in the depot. **(20297)**
- + Line blocking for battery- electric vehicles: Recurring activities are part of the line blocking procedure in order to determine the number of vehicles and the operating costs after conversion to e-vehicles. Both the temporal function of the charging process and the energy consumption definition is editable and stored within the data model. The capacity of the vehicle combinations as well as the configurations of the charging infrastructure is part of the network model. A genetic algorithm that iteratively solves graph flow problems and evaluates them by means of a parameterizable cost function generates an optimal vehicle scheduling. The state of charge of the individual vehicles is calculated for each line block element and can thus be visualized in the line block editor. **(19611)**
- + Running the line blocking procedure does no longer affect the layout and selection in the line block selection toolwindow. **(20154)**

## PuT Operating Indicators

- + Active elements of the list 'Territory PuT detail': Setting the status 'active' does not only depend on the filter settings of the Territory. Rather, both the filter of the Territory and the respective reference object (e.g., main- / line) are now evaluated. Non-filtering reference objects (e.g. operators, TSys) are always active. The filtering of the active elements is still enabled via the filter icon in the Territory PuT detail list. **(18796)**
- + Calculation for lines without main line assignment: The indicators for lines without assigned main lines are combined for their dimension. The results are as well retained when the version file is saved. **(19925)**
- + Distinction according to operator in PuT Operating Indicators: The operator is available as an additional dimension in the public transport operating indicators. **(18810)**

- + Empty rows in list Territory-PuT detail: The list for detailed PuT operating indicators for territories can now optionally also contain empty rows for elements which are defined, but don't occur in the data - e.g. for transport systems which are not used by any line. **(18607)**
- + Indicators on vehicle journey level: Additional indicators are now also displayed for time intervals at the network object vehicle journey. This includes indicators for transport supply and transport performance. The updated list of indicators can be found in the document 'IndicatorAvailability.xls'. **(18011)**
- + Intersection of links and territories in version file: The result of the intersection of links and territories, which is calculated and also used within the framework of the PuT operating indicators, is now saved in the version file. A later repetition of the calculation with unchanged geometry of the links and territories is therefore faster. **(20016)**
- + Renamed attributes: The attributes 'Seat capacity PuT' and 'Total capacity PuT' have been renamed 'Seats PuT' and 'Total seats PuT' respectively. **(18981)**
- + Spatial PuT analysis: The length-proportional division into line route elements can optionally be deselected. This assigns each element the complete value. The distribution rules for the vehicle journey sections remain unaffected. **(18626)**
- + Vehicle Journey items: For the vehicle journey items the indicators seat-kilometer, seat mileage and seat-hour are available. The indicators for the total capacity are available in the same way. **(19670)**
- + Warning for very long passenger trip chains: Before the 'PuT Operating Indicators' procedure is executed, a warning is now issued if there are passenger trip chains in the network whose stay time is longer than one hour. The stay time of passenger trip chains is estimated as service time, so that unintentional long passenger trip chains, e.g. as they occurred during GTFS import with the Add-In (up to Visum 17), can have a large influence on this. **(19359)**

## Scenario Management

- + Format of data base: The data base format has been converted to SQLite. The data base of projects, that are started in older Versions of PTV Visum, are automatically converted. **(19535)**
- + Global layouts for scenarios: Global layouts can now also be managed in a scenario management project. You can assign a global layout to a scenario that is used when the scenario is opened. You can also explicitly apply a global layout to another scenario to obtain a view suitable for displaying certain results, for example. **(17729)**
- + Grouping: Like in other lists, columns in the grid of the scenario management project can be grouped. **(18838)**
- + Long Indicators: Indicators in scenario management projects are no longer restricted to 1024 characters but can be up to 1MB. Although indicators of this length may not be displayed completely in the scenario table, it is still possible to copy the value from the cell. **(19547)**
- + Network UDA: User-defined attributes (UDA) defined for network can be accessed directly when selecting attributes for scenario indicators. **(19257)**
- + Scenario indicators: The calculated scenario indicators are additionally saved in a text file in the folder of the corresponding scenario. **(19517)**
- + User-defined attribute (UDA): User-defined attributes have been introduced for objects of the scenario management project, namely for scenarios, modifications and procedure parameter sets. **(16334)**

## Schematic Line Diagram

- + Arrange center labels using the toolbar: The action 'Arrange centered labels' is now also accessible via the toolbar of the schematic line diagram. **(18601)**
- + Graphic parameters dialog for inner classification of edge courses resizable: The graphic parameters dialog for editing the inner classification of a double classification of edge courses is now resizable. **(17962)**

## Subnetwork Generator

- + Adopt time-varying attributes: When cutting a subnetwork, the definitions and values of time-varying attributes are now also transferred to the subnetwork. **(19571)**
- + Dynamic subnetworks: Subnetworks can be generated from network with dynamic assignments. For the allocation of demand to a time interval the entry time (and exit time, respectively) is considered. Pre-condition is the use of matrix time series. **(10825)**

## Timetable Editor

- + Comparison of run and dwell times also for opposite direction: In the dialog 'Comparison of run and dwell times', time profiles and system routes in the opposite direction are now also taken into account. Furthermore, this dialog has been modernized so that, for example, copy & paste and simultaneous input into several cells of the table are possible. **(18621)**
- + Edit vehicle journey: While changing the line route of a vehicle journey PTV Visum now suggest the most suitable time profile and direction. **(18429)**

- + Improved initial sorting in tabular timetable: When opening the tabular timetable, an improved sorting according to the stop sequence item with the most vehicle journeys is now produced. This sorting requires more time for a large number of vehicle journeys, but the process can be canceled in the progress dialog. In this case the vehicle journeys are sorted as before according to the departure time (without consideration of the departure point). **(18807)**
- + It is now possible to merge line routes with different number of time profiles. If one of the line routes to be merged has more than one time profile, a dialog is shown which allows to map the time profiles of the two line routes or to trigger the computation of new time profiles from the network run times. **(14009)**

## Visum Files

- + Attribute files with extended header: When saving attribute files it is possible to optionally save extended attribute descriptions and a line with long names of attributes. This option can also be accessed via COM. **(18811)**
- + Column charts in the global layout: The settings for open column charts in the network editor are now also saved in the global layout file. **(18894)**
- + Default project directory on version file folder: The default project directory for almost all file types is now the respective folder of the currently loaded version file. In other words, after opening a version file in the program, Visum behaves as if the version file had been opened by double-clicking in the Explorer. In particular, the version file and the other files used in it can be shared if relative paths are used in the version file by copying the whole folder. **(19035)**
- + Desire line in the global layout: The settings of the desire line are now saved in the global layout. **(18893)**
- + File extension for PrT skim matrices: The file extension for PrT skim matrices written in csv format has been changed from 'CSV' (in upper case) to the common extension 'csv' (in lower case). **(19370)**
- + Flow bundle definition in global layout: Global layout files now also contain the flow bundle definition. **(18891)**
- + Graphic tools parameters in global layout: The global layout file now also contains the parameters for the graphic tools shortest path search, isochrones, and turn volumes. **(14126)**
- + Open Visum xml files: Opening xml files via Drag & Drop is also possible, if these are not procedure parameters. User settings and script menu files will be applied immediately. For further files, the message, that they cannot be opened from the main window appears. **(10391)**
- + Text-based file exports in English: Until now, all text-based Visum files (i.e. network file, attribute file, demand file, model transfer file, interval file and multi-line survey data) were written in the language set for the user interface if it was German, English, French, Italian, or Polish. Now it is always possible to export in English, regardless of the languages available in the license. A user setting can be used to switch between English-language and localized export. **(18849 !)**
- + Read/write version files with assignment results faster: The reading and writing of version files with assignment results has been accelerated. **(18920)**

## ! Breaking Changes

### COM-API

- ! Changed default value for empty values of user-defined attributes: the default value for the property 'Allow empty values' was changed to 'false'. Thus, new user-defined attributes don't allow empty values if the setting remains unchanged. This affects scripts which create user-defined attributes through COM. When the function `AddUserDefinedAttributes` is called in a script without passing a value for the optional parameter 'CanBeEmpty' the behaviour will change. **(10302)**
- ! `IAnalysisTimes` no longer exists: The COM object `IAnalysisTimes` was removed during the conversion of the time interval sets (18222). It is now replaced by the `ITimeIntervalSet` objects. To establish compatibility, the access function `IFunctions.AnalysisTimes` still exists, but it returns the `ICalendarPeriod`, whose interface looks like the previous `IAnalysisTimes`. However, this access will be removed in the next major version. **(20083 +)**
- ! Module `pytables` leads to crashes: The current version 3.3.0 of `pytables` (directory name tables) delivered with PTV Visum leads to non-deterministic crashes depending on data and computer. To avoid this, the version was updated to version 3.4.4. Due to incompatible changes in this version, scripts that use `numpy` must also be adapted. **(20118)**
- ! Paper size and orientation when printing: When printing using the `IGraphic::PrintNetEditor2D` method, the paper size and orientation of the print page can now be specified as optional parameters. Because of the additional parameters, applications that integrate the COM API via Early Binding must be rebound. **(18073 +)**
- ! `SetObjects` of a PrT path list changes column selection: If an `IPrTPathList` or `IPrTPathLinkList` object was implicitly switched from assignment paths to user-defined PrT paths by calling the `SetObjects` method and a PrT path set specified instead of a demand segment, the list then had the default attribute selection for user-defined PrT paths, even if it had no attributes previously. This error has been fixed. **(20103)**
- ! Shapefile export truncates file name: If the file name specified in the `IIO.ExportShapefile` function contained a point, it was truncated at the first point during export. This bug has been fixed. This may change the resulting file names, even with existing scripts. **(20196)**

- ❗ Switch of the working directory when executing scripts: Previously, when executing a script, the working directory of PTV Visum was switched to the folder in which the script code could be found. Depending on the settings of the project directories, this also affected the subsequent loading of files. This switch no longer takes place, i.e. the set project directories remain untouched in any case. However, scripts that have relied on the switch of the working directory must be adapted to the new behavior. **(19437** [+](#))

## Calculation

- ❗ Two-way stops: Results are different, when there is a major flow with non-zero grade. **(20367** [✓](#))

## Data Model

- ❗ Consideration of switched off SC: If a signal control was switched off according to its properties, (main) nodes using this signal control were partly treated as signalized nodes anyway - especially in the ICA calculation. This error has been corrected. This changes the results of the ICA calculation and all assignments, as far as they use node impedances according to ICA, in particular the assignment with ICA. **(18854)**
- ❗ Default transport systems for main turns from underlying network: Previously, the default transport system set for a newly inserted main turn was the cut set of the transport system sets of the incoming and outgoing link, as for turns. Now, those transport systems are removed from this cut set for which there is no path between these two links in the underlying nodes-links-turns network. As a result, certain turns may be closed by main nodes, and PrT assignment results change accordingly. **(19322)**
- ❗ Line network length at main lines: The attribute 'Line network length (directed/undirected)' showed the sum of the corresponding attributes of the lines of the main line instead of the total length of all links of the main line, so that links used by different lines entered the attribute several times. This error has been corrected. **(18827)**
- ❗ Line network length at transport system and operator: At the network objects transport system and operator, the attribute 'Line network length (directed/undirected)' displayed the sum of the corresponding attributes of the lines with a suitable transport system or operator instead of the total length of all links travelled by these lines, so that links travelled by different lines entered the total several times. This error has been corrected. **(18861)**
- ❗ User-defined time interval sets: It is possible to define multiple time interval sets. The time intervals within one set may vary in duration, but cannot overlap. The time interval sets are network objects and are no longer available in the General procedure settings. Only one time interval set can be used for analysis time intervals. **(18222** [+](#))

## Demand Procedures

- ❗ Invalid values in the output matrices of the tour-based model: If the procedure 'Tour-based model - combined distribution/mode choice' was executed, invalid values (NaN, 'not a number', and similar) could occur in the output matrices if rubber banding was used for calculation. This bug has been fixed. Due to a changed execution order, there may be minor numerical deviations in the output matrices. **(20347** [✓](#))
- ❗ Numerical difficulties in Nested Demand: In the 'Nested Demand' procedure, overflow/underflow problems could occur when calculating the log sums if all impedances were very large or very small. This error was corrected. This also results in more accurate results. In particular, there are small numerical deviations in the calculation results. **(18968)**

## Formulas

- ❗ TableLookup without suitable object: The function TableLookup returned the value of the expression specified as the third parameter even if there was no network object that satisfied the condition (formulated in the second argument) as long as the expression did not access attribute values of the network object that satisfied the conditions. This error has been fixed, i.e. if there is no network object that meets the condition, TableLookup now always returns an empty value. This may change the results of calculation steps defined by formulas. **(17879)**

## Installation

- ❗ Spelling mistake in the user settings: The previous user setting 'ActicityProtocolLevel' is renamed to 'ActivityProtocolLevel'. The corresponding entry in the registry will be renamed accordingly compared to PTV Visum 18. **(19521)**

## Matrix Editor

- ❗ More stable calculation for matrix and row sums: The calculation of matrix and row sums in the Matrix Editor has been improved. Only interactive editing in the Matrix Editor can cause small inaccuracies. This can change the values of matrix and row sums. **(20436** [+](#))

## Other Procedures

- ❗ Signal offset optimization: A new version of the solution method has been added for the 'Signal offset optimization' procedure. This may change the results of the procedure. **(18869** [+](#))



- ❗ Calculation of emissions with HBEFA temporarily disabled: In the course of updating to the new version HBEFA 4.1 which was released in September 2019, the calculation of emissions is temporarily completely disabled - even for older versions of HBEFA. PTV Visum 2020 will exclusively support HBEFA 4.1 for the calculation of emissions. Due to the various changes in HBEFA, existing procedure parameters and model data need to be adjusted and results will differ from previous versions. The functionality will be enabled again in an early ServicePack expected for autumn 2019. **(20531 +)**

## PrT Assignment

- ❗ Assignment with ICA with Bi-conjugate Frank-Wolfe as internal assignment incorrect: In the ICA assignment, when using the Bi-conjugate Frank-Wolfe assignment as internal assignment, the ICA calculation was not calculated based on the correct data from the assignment. As a result, the assignment with ICA may not have converged. This error has been fixed. This changes the results of the assignment with ICA when Frank-Wolfe is used as internal assignment. **(19872)**
- ❗ Calculation error in fast variant of the blocking back model: The blocking back model provided incorrect results if the option 'Exploit capacities evenly (faster)' was active and only turn capacities, but no link capacities were taken into account. This error has been fixed. This combination is used in particular in assignments with ICA, the results of which change as a result. **(18183)**
- ❗ Calculation error when optimizing the proportionality in LUCE: With the PrT assignment procedure 'LUCE', a calculation error could occur when the option 'Optimization of the proportionality of route volumes at meshes' was activated, so that no real numerical value was output as volume. As a result, the ICA calculation could not be carried out correctly. This bug has been fixed. This potentially changes all assignment results calculated with LUCE and proportionalization switched on. **(18904)**
- ❗ Congestion starts for no reason in case of blocking-back calculation: If the calculation of congestion according to the blocking-back model was activated, congestion could occur in the network without reason if transport systems with passenger car units other than 1 were involved. This error has been fixed. This changes the assignment results of PrT assignments with the blocking-back model switched on as well as the results of assignment with ICA. **(20090)**
- ❗ Effect of SC daily schedules in SBA: In simulation-based dynamic assignment (SBA), daily schedules of signal controls in the assignment time interval are taken into account. More precisely: For a signal control of the type Vissig, a daily schedule can be selected via an attribute, which then takes effect. For RBC controls, a daily schedule coded in it always takes effect if it exists, otherwise the set signal program takes effect continuously. If there are RBC controls with daily schedules in the network, the assignment result changes when SBA is used. **(16497 +)**
- ❗ Extension of roundabouts within SBA: For roundabouts where the leg attribute 'Number of conflicting lanes' had different values, the number of lanes within the roundabout was not generated correctly. This error has been fixed. The number of lanes within the internally expanded roundabout is the maximum of the number of conflicting lanes (leg attribute) and the number of lanes of the incoming link. The number of conflict lanes (leg attribute) are mapped as the number of lane turns of the nodes of the SBA internally expanded roundabout. **(19825)**
- ❗ Factor before tCur in the impedance function can cancel closure: If a coefficient smaller than 1 is specified in the impedance definition for the travel time in the loaded network tCur, closed links (e.g. with an empty transport system set) in the assignment variants (classic) 'Equilibrium assignment', 'Equilibrium assignment LUCE', or 'Equilibrium assignment Bi-conjugate Frank-Wolfe' could still be used under certain circumstances, but in practice only with extremely small pre-factors. This error has been fixed. The assignment results of the three procedure variants mentioned can therefore change in the affected networks. **(19873)**
- ❗ ICA calculation for Two-way stops: The type of site, i.e. 2-lanes, 4-lanes, or 6-lanes, is now determined by the major flow approach with the larger number of through lanes. Node impedances calculated using ICA method and thus the assignment with ICA differ, if the approaches of the major flow have a different number of inbound through lanes. **(20390 +)**
- ❗ ICA calculation for capacity or saturation flow rate 0: A capacity or saturation flow rate of 0 was not handled correctly in the ICA calculation. This error has been fixed. This changes the results of the assignment with ICA. **(18890)**
- ❗ ICA calculation in assignments: When calculating an assignment, impedances at nodes are determined using the node impedance calculation according to ICA. If an error occurred during the calculation of the node impedances, the assignment itself was not canceled until now. This error has been corrected. As a result, assignment might be aborted in more cases. **(18850)**
- ❗ SBA assignment with balancing time intervals of different lengths: If the balancing time intervals in a simulation-based dynamic assignment (SBA) had different durations, the calculation of the travel times and thus of the gap reached as well as the balancing between alternative paths were faulty. This has also impaired convergence behaviour. This error has been fixed. **(19823)**
- ❗ Skim matrix calculation for impedance in the stochastic assignment: It is possible to calculate a skim matrix for the total impedance with in the stochastic assignment. This skim matrix contains components of the impedance defined over the entire path. The results of the stochastic assignment can change if the impedance component for the entire path results in an empty value. **(17670 +)**

- ❗ Speed-up: The evaluation of volume-delay functions has been accelerated. The shortest path search within the classical equilibrium and the incremental assignment, respectively, has been multithreaded. These modifications result in changes of the assignment results for the methods BFW, classical equilibrium, and the incremental assignment. **(16995 +)**
- ❗ Temporary closures in SBA: Temporary closures of a link that are modeled using a temporary value of the transport system set attribute are now taken into account in simulation-based dynamic assignment (SBA). Naturally, this changes the assignment result if there are temporary closures in the network. **(19004 +)**
- ❗ Turning on red in SBA: In the simulation-based dynamic assignment (SBA), turns where turn on red is permitted were handled incorrectly: Vehicles could only drive in case of a green light, but then the set gaps took effect, so that the capacity was even lower than without turning on red. This error has been fixed, i.e. the set gaps now take effect in case of a red light, and vehicles can move unhindered when the light is green. This changes the assignment results of the simulation-based dynamic assignment (SBA). **(18817)**
- ❗ Turns with capacity 0 in assignment with ICA and LUCE: In the Equilibrium assignment LUCE turns with a capacity of 0 were previously always considered closed. However, this criterion does not necessarily apply to ICA assignment. As a result, if LUCE assignment was used as a subordinate assignment in ICA assignment, turns with a capacity of 0 were never used. This error has been fixed. This changes the results of LUCE assignment and ICA assignment with LUCE as subordinate assignment. **(19849)**
- ❗ User-defined VD functions for nodes and turns dependent on the transport system: So far, user-defined VDF could depend on the transport system, in principle. However, nodes and turns for which the impedance was calculated by such a VDF were always blocked, i.e. no transport system was permitted on those objects. From now on, transport system dependent user-defined VDF are only allowed for links, user-defined VDF for nodes and turns must be the same for all transport systems, i.e. independent from the transport system. **(19615)**
- ❗ User-defined ideal flow rate for node impedance according to ICU: The user-defined ideal flow rate was not taken into account when calculating node impedances for signalized nodes according to ICU for left turns. This error has been fixed. This may change the assignment results. **(19202)**
- ❗ VD function 'Akcelik2' at length 0: The VD function 'Akcelic2' returned  $t_{Cur} = 0$  at length 0. In particular, the travel time in the loaded network  $t_{Cur}$  may have been lower than the travel time  $t_0$  in the unloaded network for each turn. This error was corrected by issuing  $t_{Cur} = t_0$  at length 0. This changes the results of all PrT assignments when using this VD function. **(18820)**
- ❗ Wait time from blocking back in assignment with ICA: In assignments with ICA, the wait time resulting from congestion on links with a constant VD function was ignored. This bug has been fixed. This changes the results of the assignment with ICA in networks with blocking back and constant VD functions. **(19867)**
- ❗ Warmstart in the equilibrium assignment: When using the option 'Use current assignment results as initial solution' inconsistencies in the results could occur. This error has been fixed. This changes the assignment results using this option. **(19776)**
- ❗ ICA, signalized nodes: When a leg has more than one right turn or more than one left turn, and the lane turns to different target legs originate from different lanes, these lanes are no longer put in the same lane group. Instead, there is a lane group for each target approach. **(20318 ✓)**

## PuT Assignment

- ❗ Preselection in the iterative variants of the timetable-based assignment: If a second search is carried out in a capacity-restricted timetable-based assignment or in a timetable-based assignment with Sharing transport systems and if there are two equivalent connections for an OD pair from the first search, but none at all from the second search, many paths are unjustifiably omitted in the preselection of the second search. This error has been fixed. As a result, the result of the timetable-based assignment changes significantly in affected cases. **(20317 ✓)**
- ❗ Round volumes: Rounding of volumes within a capacity restricted PT assignment, i.e. also when vehicle sharing systems are considered, is suppressed because it has a negative effect on convergence. In the last iteration the volumes of the connection are rounded. This changes the assignment results as well as the skim matrices. **(19399 +)**
- ❗ Rounding of demand and passenger volumes: Rounding of demand and passenger volumes have been improved for the PuT assignment. It can be rounded using decimal places or multiple of a pre-defined number. Results of the assignment and related analyses like skim calculations, flow bundle change. **(18432 +)**

## PuT Line Blocking

- ❗ Considering depot capacities: Depot capacities were incorrectly taken into account during line blocking. This error has been fixed. This can lead to different results in the blocks as soon as capacities in depots should be taken into account. **(19984)**

- ❗ Layover in depot as block item type: Previously, individual block item types of the category 'Layover' could be flagged as taking place in the depot using an attribute. Other cost rates then apply in line blocking. This attribute 'In depot' no longer exists. Instead, there is a separate system-defined block item type 'Layover in depot', which marks a block item as a layover in the depot. The introduction of the new system-defined block item type increases the numbers of user-defined block item types by one when importing version files from PTV Visum 18 and earlier. This also affects attributes with subattribute block item type number, so that the corresponding values can now be found under the number increased by one. **(20297 +)**

## PuT Operational Indicators

- ❗ Line network length at territory: For each transport system, the links traversed by several lines of the transport system were counted several times for territories in the attribute 'Line network length (directed/undirected)'. Moreover, in the undirected variant, the entire link was used for the reverse direction instead of only the respective share in the territory. These errors have been corrected, which changes the corresponding indicators. **(18860)**

## Visum Files

- ❗ Text-based file exports in English: Until now, all text-based Visum files (i.e. network file, attribute file, demand file, model transfer file, interval file and multi-line survey data) were written in the language set for the user interface if it was German, English, French, Italian, or Polish. Now it is always possible to export in English, regardless of the languages available in the license. A user setting can be used to switch between English-language and localized export. The default value of this user setting is the English export, so that the program behavior changes unless the user setting is explicitly switched. **(18849 +)**

## Line blocking

- ❗ Runtime improvement: The run time of the line blocking procedure has been improved, specifically when recurring activities are considered. This may result in different - but equivalent - results in all variants of the line blocking procedure. **(20392 +)**