**Description:**

An extension to the ITRC interdependency network database model, including database schema, wrappers and functions, to handle explicitly network attributes and their functions for the field of network modelling and simulation.

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# **Introduction**

The contents of this document sets out the form and structure of an extension to the ITRC database network schema which explicitly handles network attributes and the functions related to these.

Section 2 introduces how the extension can be utilised to analyse networks. Section 3 provides some information on the key python functions which have been developed which enable this extension to work seamlessly with the ITRC database schema model. Section 4 introduces the key PostgreSQL functions which have been developed for the handling and manipulation database-side of the network tables.

# **Using the extended database schema and functions**

Examples illustrating how to use the developed schema extension and its functionality are shown below. These show how to build a database instance of a network, how to then load from the database and create a NetworkX instance, and then how to use this to run a simulation or some analysis. Finally an example if provided for writing a NetworkX instance back to a database instance.

# **Python functions developed**

**Write class**

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| write\_to\_db() |  |
| Writes a network to the database, storing the functions and attributes in separate tables for nodes and edges if identified by the user. | |

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| add\_functions() |  |
| Adds a function to the function table with the specified unique function id, the text for the function (written in a pythonic format) and the type of function it is. | |

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| update\_functions () |  |
| Updates the function text (and the type is required) for a specified function in the function table. | |

**Read class**

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| pull\_from\_db() |  |
| Loads a network from the database with the attributes and functions if both requested and present in the database, creating a networkx network instance. | |

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| return\_network\_functions() |  |
| Returns a list of the functions in the function table. | |

Table\_sql class

# **PostgreSQL functions developed**

A number of PostgreSQL functions have been developed which enable the creation, manipulation and management of the network tables required to full fill the requirements of the developed model. The key functions which may be of interest to a user are specified below. For all others, please see the list of functions in the database itself.

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| np\_add\_edge\_attribute() |  |
| Updates the attribute value (attribute and value user specified) and the functionID (providing that specified exists in the function table). | |

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| np\_add\_function() |  |
| Adds a new function to the function table with the user specifying the functionID. | |

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| np\_add\_functionid\_to\_edge\_attribute\_table() |  |
| Updates the functionID, provided by the user, if it exists in the function table, for the specified edge record in the specified attribute table. | |

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| np\_add\_functionid\_to\_node\_attribute\_table() |  |
| Updates the functionID, provided by the user, if it exists in the function table, for the specified node record in the specified attribute table. | |

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| np\_add\_node\_attribute() |  |
| Updates the attribute value (attribute and value user specified) and the functionID (providing that specified exists in the function table). | |

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| np\_check\_attribute\_table\_exists() |  |
| Given an attribute, checks if it exists that a table exists for the specified network. | |

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| np\_check\_edge\_columns() |  |
| Given an attribute checks if this exists in the main node table. If so, appends ‘\_1’ on to the name. | |

|  |  |
| --- | --- |
| np\_check\_node\_columns() |  |
| Given an attribute checks if this exists in the main node table. If so, appends ‘\_1’ on to the name. | |

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| np\_create\_edge\_attribute\_table() |  |
| Build an attribute table for the edges in a network, provided with a name by the user. | |

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| np\_create\_edge\_view() |  |
| Generates the edge view from which the network is built from. Adds attribute columns to the edges and their geometries as requested by the user. | |

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| np\_create\_function\_table() |  |
| Creates the function table when the network is initially built using the network prefix. | |

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| np\_create\_node\_attribute\_table() |  |
| Build an attribute table for the nodes in a network, provided with a name by the user. | |

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| np\_create\_node\_view() |  |
| Generates the node view from which the network is built from. Adds attribute columns to the nodes, including their geometry, as requested by the user. | |

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| np\_delete\_all\_tables() |  |
| Deletes all tables related to the network from the prefix provided including those for the network itself and the views. | |

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| np\_update\_edge\_attribute() |  |
| Updates the attribute of the specified edge record for the supplied attribute. Checks the table exists for attempting to run the update commend. | |

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| --- | --- |
| np\_update\_node\_attribute() |  |
| Updates the attribute of the specified node record for the supplied attribute. Checks the table exists for attempting to run the update commend. | |