NSort for SSIS

A High Performance Sort Component for SQL Server Integration Services

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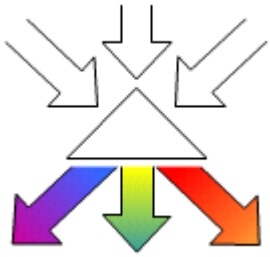
Ordinal Technology Corp <support@ordinal.com>



Introduction

The NSort transformation for Microsoft SQL Server 2005 and 2008 Integration Services, TxNsort, can be used alongside standard components during the design and execution of an SSIS project. Compared to the standard SSIS sort component, the NSort transformation:

1. Is not limited by the amount of available main memory during execution time. NSort uses temporary files to handle arbitrarily large datasets.
2. Uses less CPU and is faster.
3. Can accept multiple input streams.
4. Can partition its output data into multiple output streams which are emitted in parallel, facilitating parallel downstream processing.

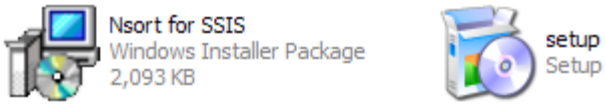
Support

Support can be obtained for NSort for SSIS by emailing support@ordinal.com, or by phone +1-925-253-9204 during normal business hours: M-F 9AM – 5PM Pacific Time.

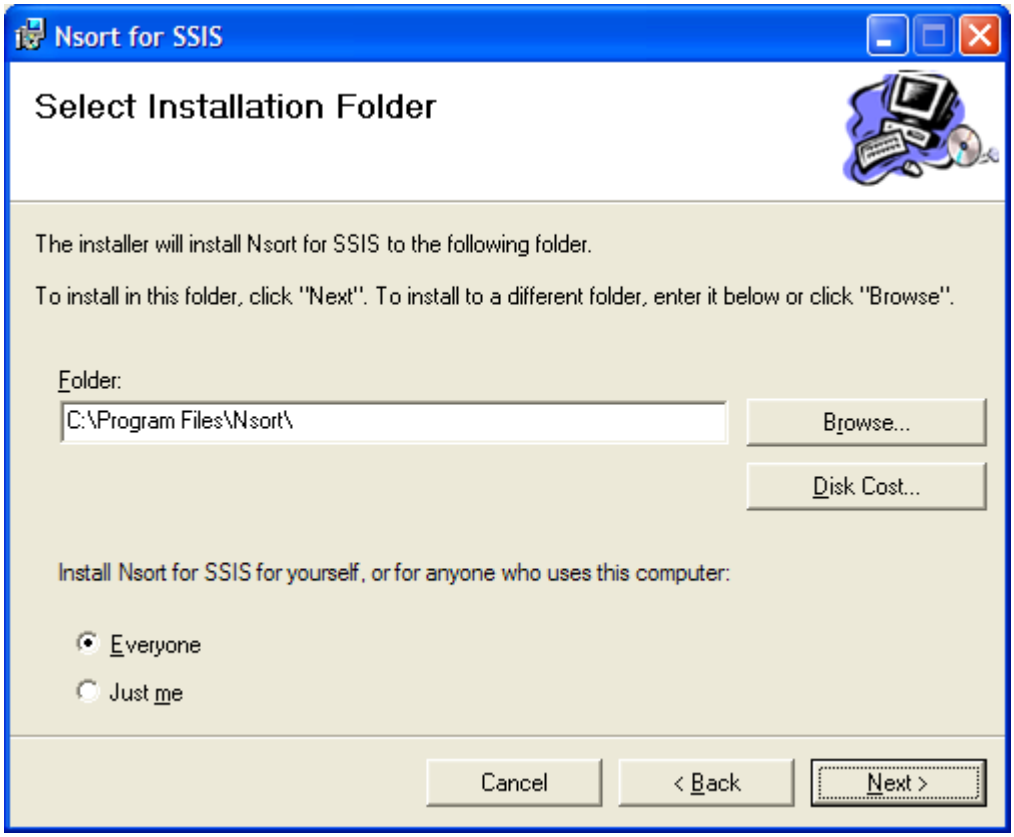
Installation

An NSort for SSIS zip file along with a trial NSort license key can be obtained from http://www.ordinal.com/try.cgi

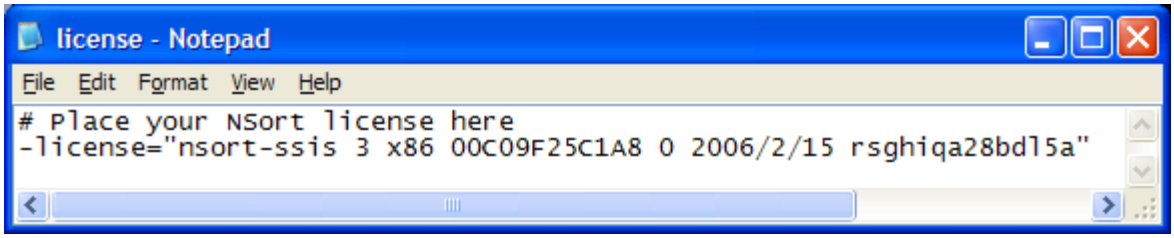
After completing the online form, you will be able to download the NSort for SSIS 2005 or 2008 zip file (x86 or x64 version) and will be emailed a trial (temporary) license key. The NSort zip file contains the following files:



To install NSort for SSIS, double-click on the *setup* icon. You will be asked to select the installation folder:



You should note the installation folder, as you need to know it to install your temporary license key. Once the NSort for SSIS installation is complete, you can install the trial license key that has been emailed to you by copying it to the *license.txt* file in the NSort installation folder. You can use the *notepad* application to do this:



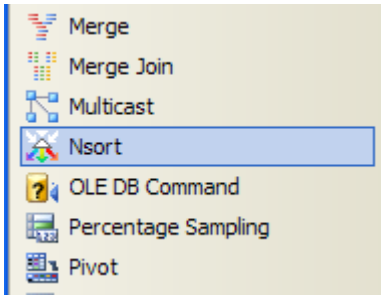
If your license key is not up-to-date or is missing, you can design SSIS projects with NSort. However the NSort component will fail during project execution and the following error message will appear in the SSIS output:

```
Error: 2006-01-25 10:26:04.37
   Code: 0xC020CC0A
   Source: Data Flow Task Nsort
   Description: Nsort library reports nsort_define() error: (<current program>)
NO_LICENSE: A -license="<license string>" statement is needed to run nsort
New license info for yourservername: nsort-ssis 3.3.11 x86 00C09F25C1A8 1 2
```

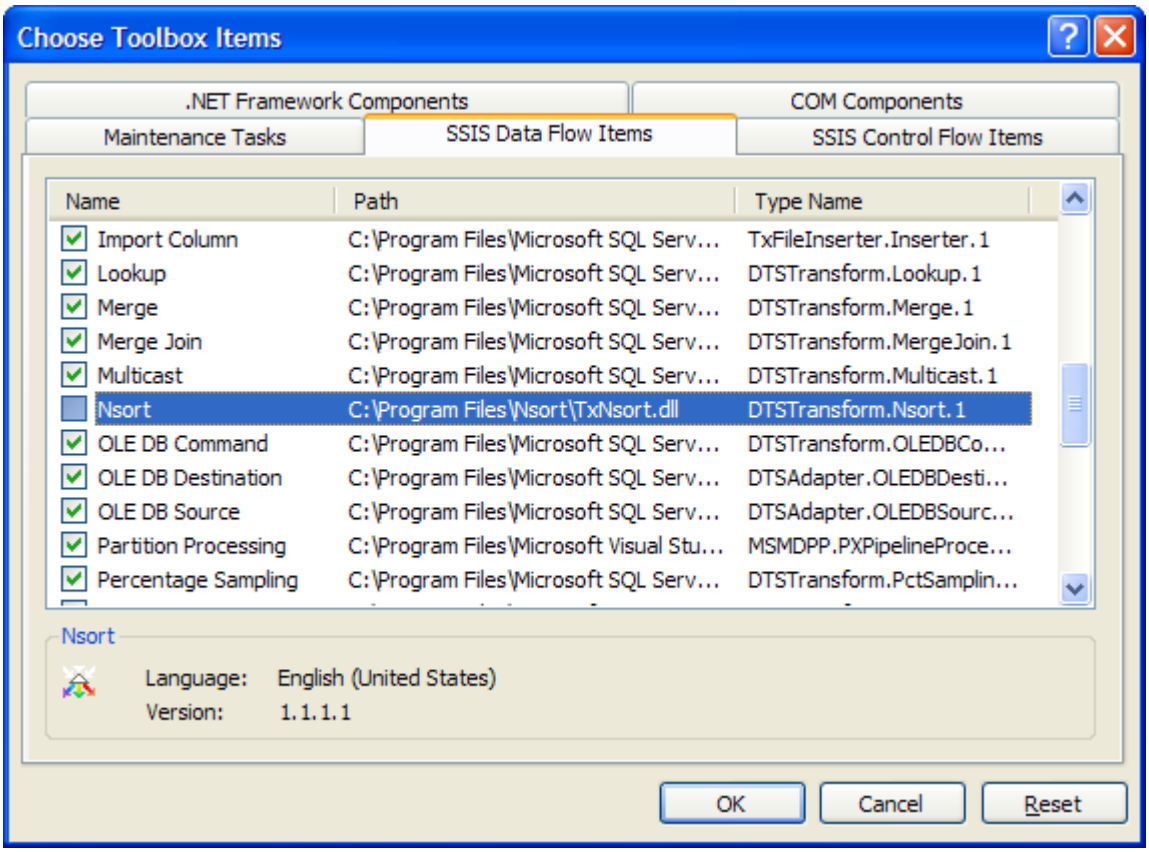
You can usually get another temporary license key at http://www.ordinal.com/temporary.cgi by copying the last line of the error message (the one starting with “New license info...”) and pasting it into the form on the website. You will be emailed a new temporary license key that you will need to copy into the *license.txt* file.

Getting the NSort in the Toolbox

Once NSort for SSIS is installed, you should configure your Business Intelligence Development Environment so that NSort appears in the Toolbox alongside the standard Data Flow Transformations:



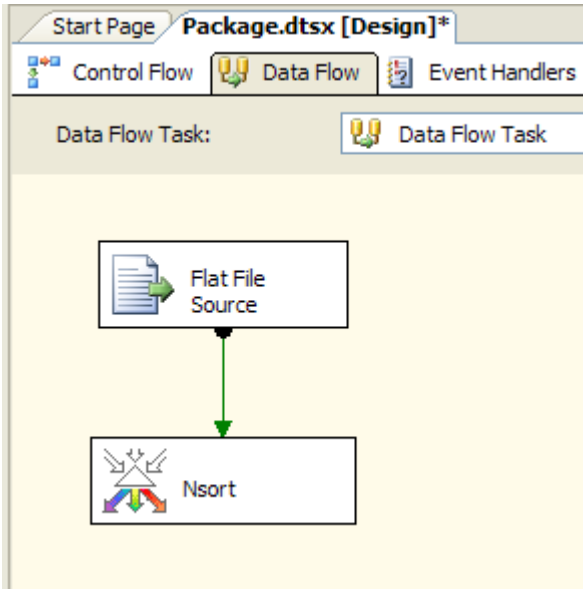
To have the NSort component appear in the toolbox with the standard data flow transformations, select *Choose Toolbox Items...* from the *Tools* menu, select the *SSIS Data Flow Items* tab, find the NSort component and make sure it is checked, then click on the *OK* button.



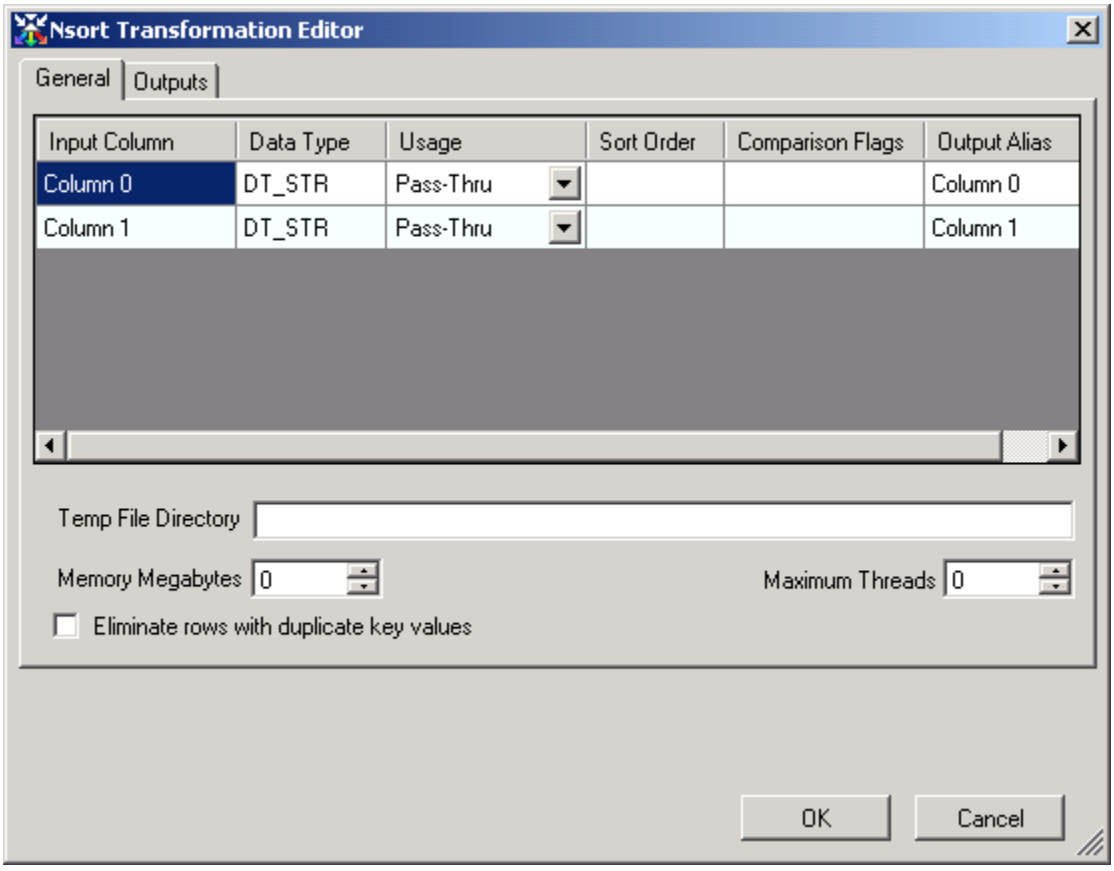
The NSort component should now appear in the toolbox with the Data Flow Transformations, albeit at the end of that group. Its place in the toolbox can be modified by dragging it to the desired (alphabetical) location

Using the NSort Transformation

To use the NSort transformation, drag the NSort icon from the toolbox onto the Data Flow design surface. Once the upstream components are properly configured, their output can be connected to the NSort component:



With the NSort component's input connected, you can double-click it to open its transformation editor:

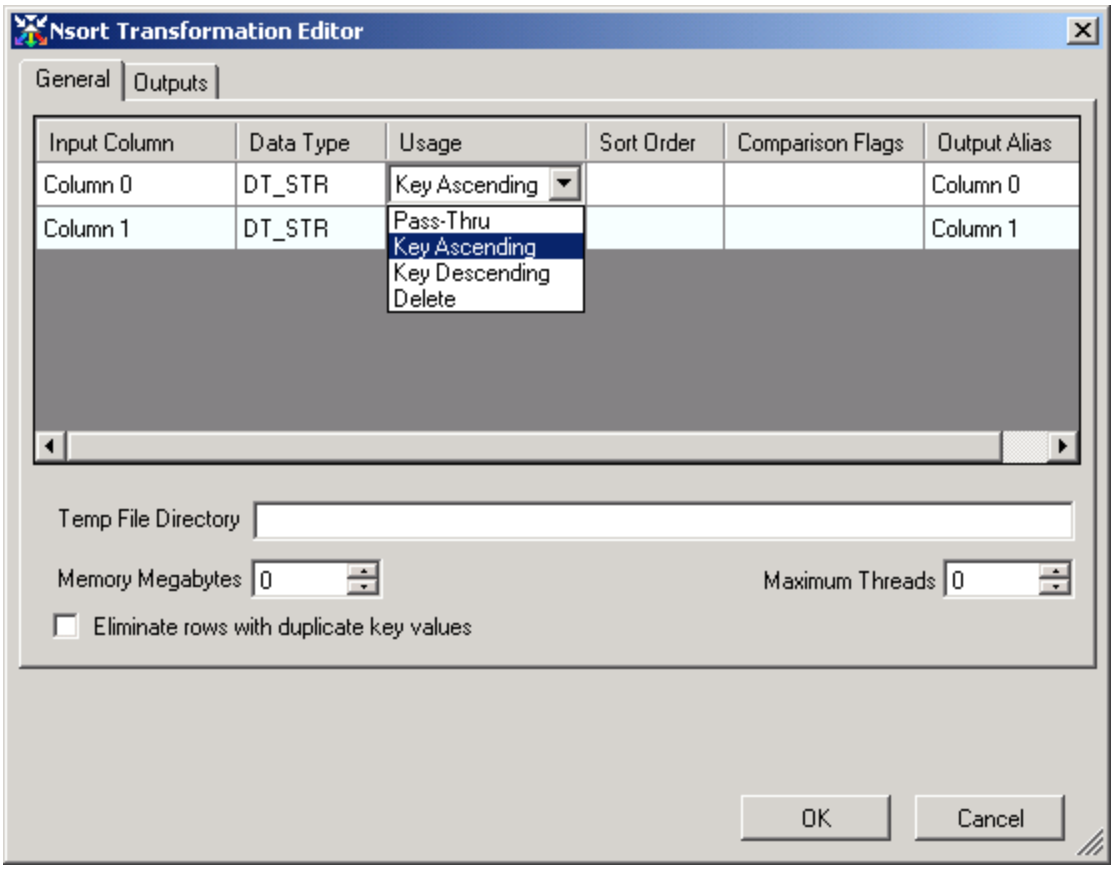


Input Column Usage

Each NSort input column is displayed in the editor. Input columns can be used in 4 different ways:

- *Pass-Thru* – (default) the column is passed through the NSort transformation without being used as a sort key.
- *Key Ascending* – the column is used as a sort key in ascending (lowest to highest) order.
- *Key Descending* – the column is used as a sort key in descending (highest to lowest) order.
- *Delete* – the column is not used in the sort, and does not appear in the output.

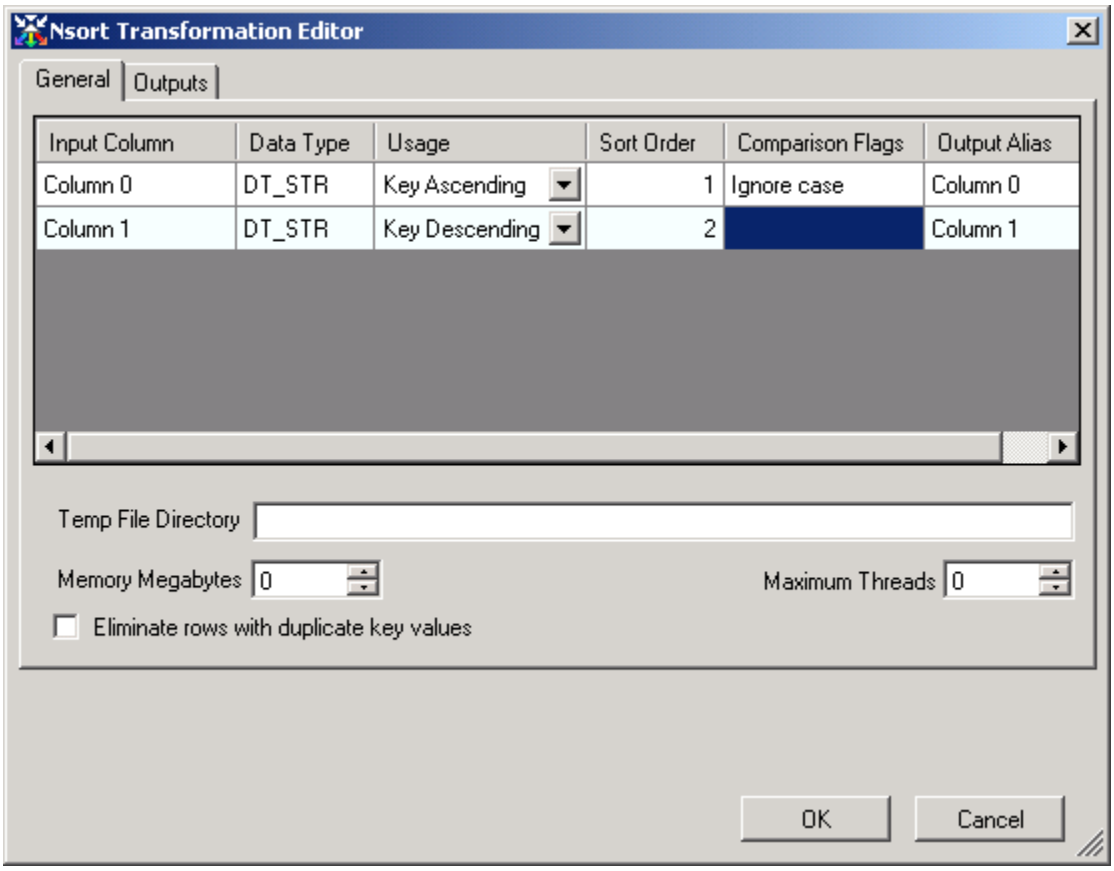
The input column's usage can be specified in its *Usage* box:



Note that NSort orders NULL columns as lower than the lowest non-NULL value.

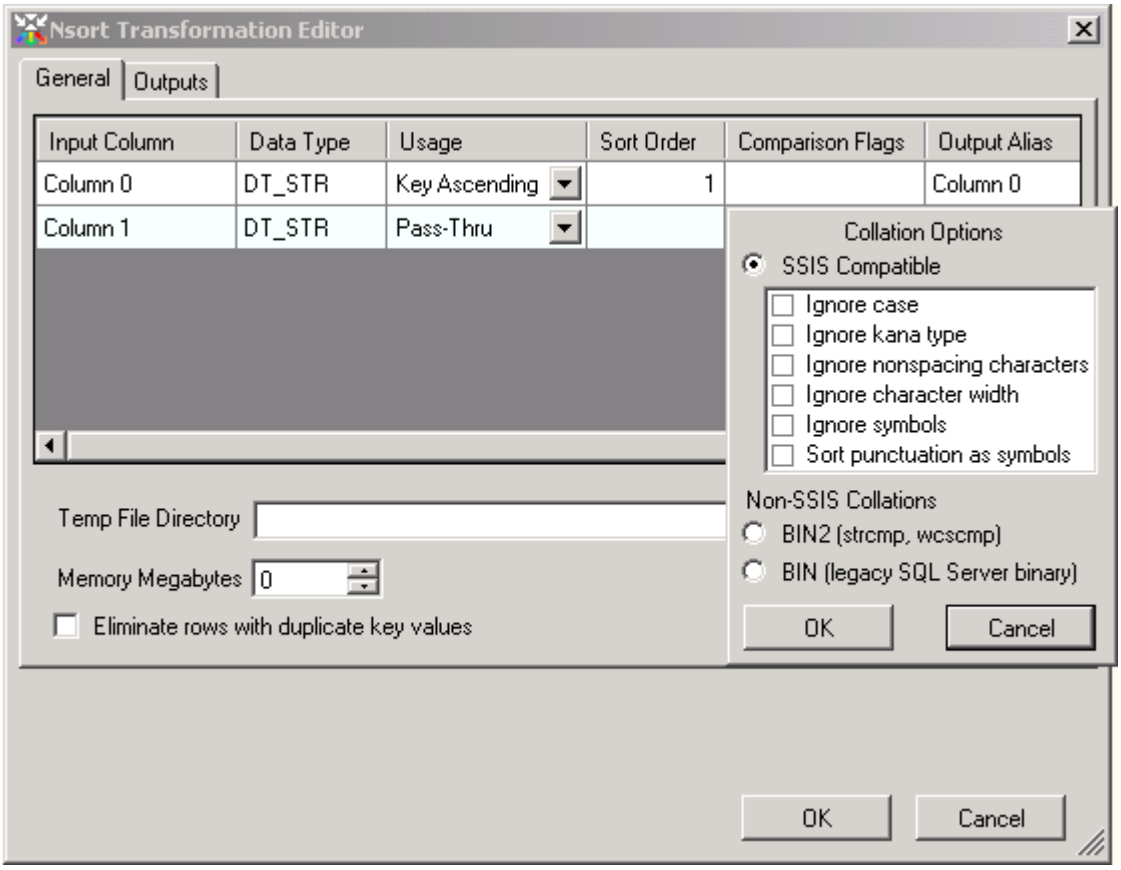
Multiple Keys

If multiple keys are defined, NSort will sort records primarily on the first key. If it finds records whose first key values are equal, NSort will use the second key to determine the row order. An arbitrary number of keys can be defined. The *Sort Order* attribute displays the order in which the keys will be used, and may be modified to change the key order. The easiest way to define keys is in their intended order as NSort assigns the key sort orders sequentially:



Comparison Flags

String data type keys (**DT_STR** and **DT_WSTR**) can also have collation options specified. There are 6 standard SSIS collation options, and two non-standard. These are defined in the *Comparison Flags* box:



The 6 standard options require more CPU usage, and must be used when NSort's output is directed to standard SSIS transformations that require sorted input (e.g. Merge Join).

There are also two binary, non-SSIS collations available which are generally faster than the SSIS-compatible collations.. While the *BIN* and *BIN2* collating sequences are supported by the SQL Server database system, they are not recognized by the standard SSIS components which require sorted input (e.g. MergeJoin).

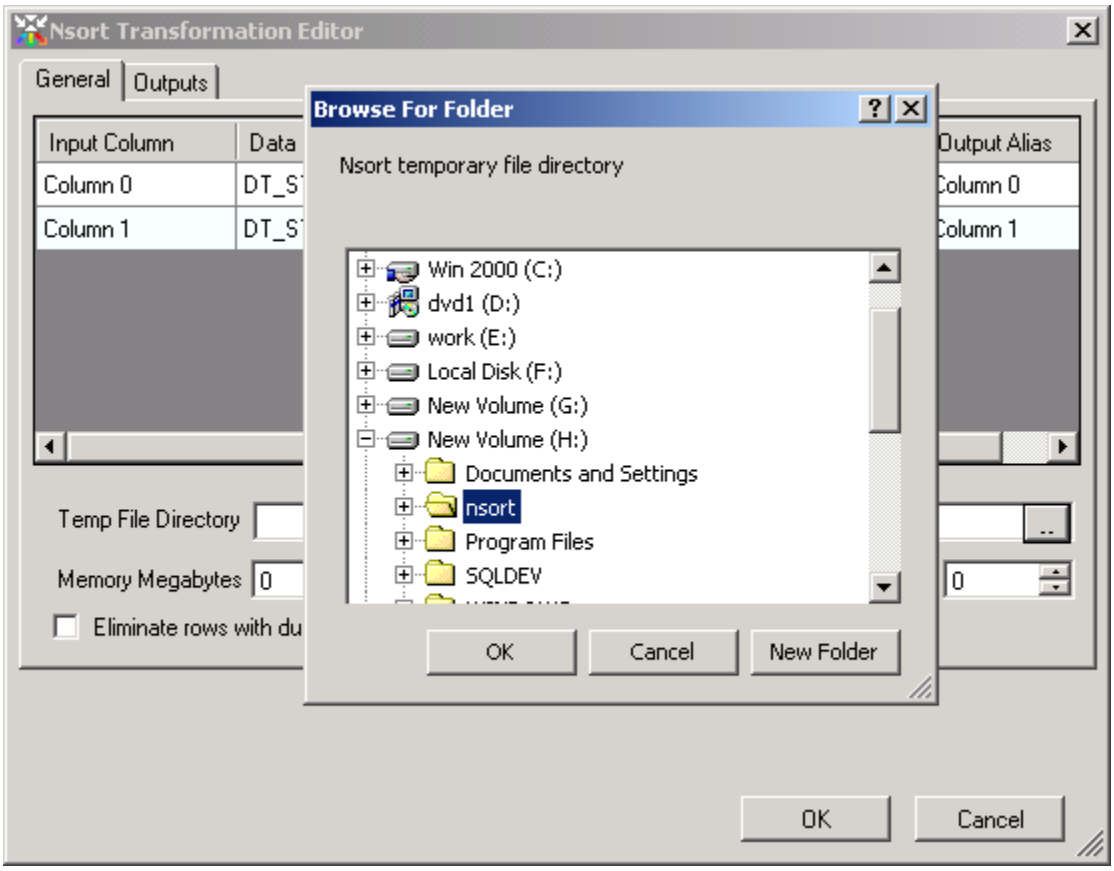
Normally, NSort indicates in its output metadata how its output is sorted so that downstream components can utilize that order. To prevent the erroneous use of BIN or BIN2 NSort output by standard SSIS components, NSort will make the following modifications to its output metadata:

- The key column with a BIN or BIN2 option will not be marked as a sort key.
- Any subsequent keys (keys with a higher sort order) will not be marked as sort keys.
- If the first NSort key uses BIN or BIN2, NSort will indicate its output is *not* sorted.

Temporary File Specification

The *Temp File Directory* box can be used to specify a temporary file to hold data which does not fit in the NSort transformation's memory. If the data set fits in NSort's virtual memory (including NSort control data), the temporary files are not created. If NSort needs to write data to a temp file and none has been specified, it will create a temp file in the default system temp directory.

If the project data is being read from a file or written to a file, best performance can be obtained by using a temp directory on a disk that is physically distinct from the disk(s) containing input file and output file. Click on the small box at the right of the Temp File Directory box to choose a temp file directory:



Duplicate Key Elimination

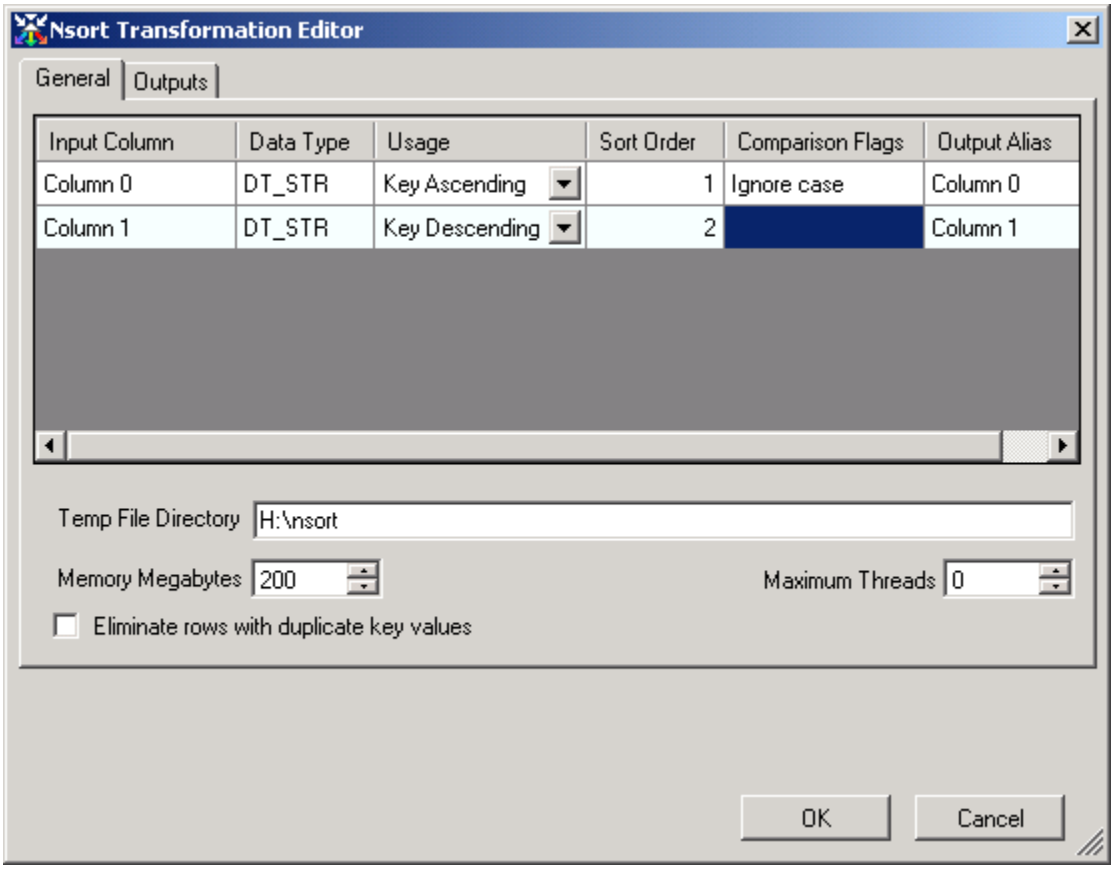
You can check the *Eliminate row with duplicate key values* box to have NSort allow only one row for each set of unique key values.

NSort Threads

The *NSort Threads* box controls the number of sort threads used by the NSort. Leave it at 0 to have NSort use one thread for each processor in the system.

Memory Megabytes

The *Memory Megabytes* box may be used to specify the megabytes of main memory that NSort can use to sort. In the below example, the specified memory size is 200 megabytes:



For each row that NSort stores in its allocated memory, it will use an extra 12 bytes of memory with 32-bit installations, or 16 bytes on 64-bit installations. For data sets that will not fit in the available physical memory, NSort can write partially-sorted data to temporary files and then read it back.

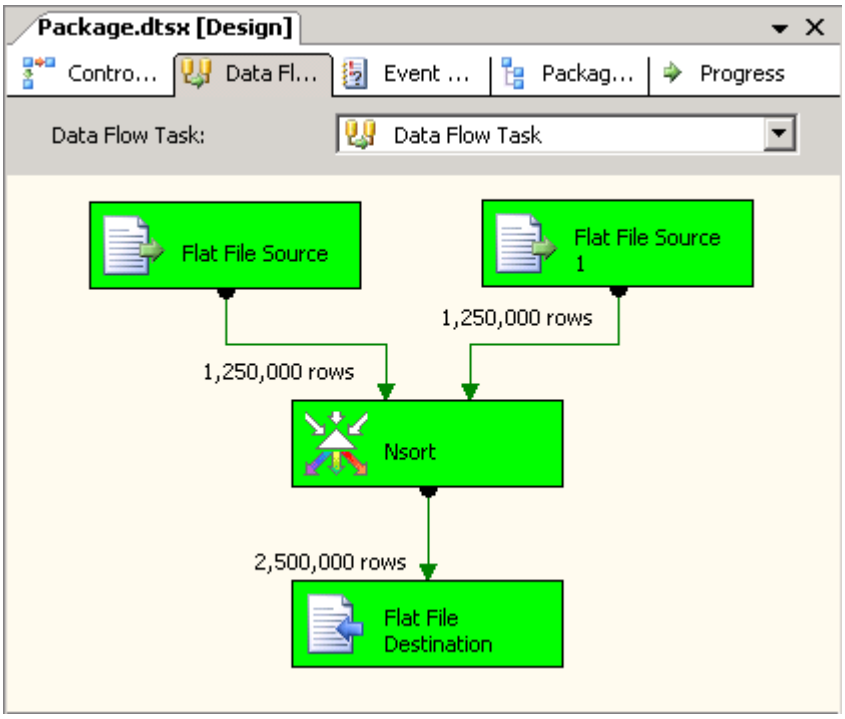
The specified amount of memory should never be more than 90% of the available physical memory in the machine as this will cause paging activity. NSort temporary file usage is always much faster than Windows paging.

When the SSIS package is run in 32-bit mode, each NSort output is restricted to using no more than 2 gigabytes of memory. A multiple-output NSort component can use more memory, as its memory use can be allocated in multiple sections (one per output). NSort will try to allocate the specified amount of memory. If it can't, it will repetitively multiply the requested amount by .75 until its memory allocation succeeds. The Information Events produced by NSort report the actual amount of memory used.

Parallel Inputs

NSort can accept an arbitrary number of inputs, provided that all inputs contain the same column names and metadata. This can facilitate the parallelism of upstream processing. NSort will combine and sort the rows it receives from its multiple inputs. The number of NSort inputs does not need to be explicitly declared. Rather, new inputs can simply be attached to the NSort component as desired. The behavior of multiple NSort inputs is similar the standard SSIS *Union All* component. However using multiple NSort inputs can be faster than connecting those same streams to a Union All component and then connecting its output to NSort.

The following screen shot was taken at the end of a debug run in the Business Intelligence Design Environment. It shows an NSort component with 2 inputs and 1 output.

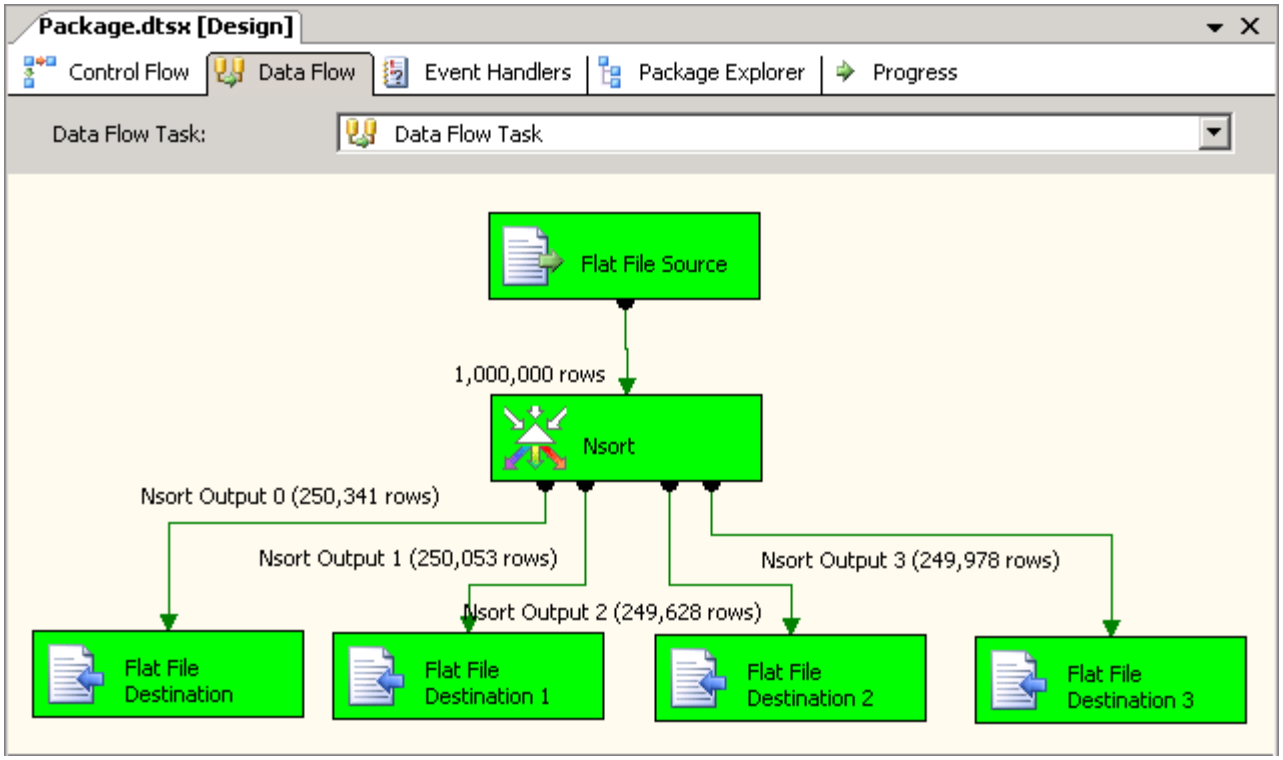


Parallel Outputs

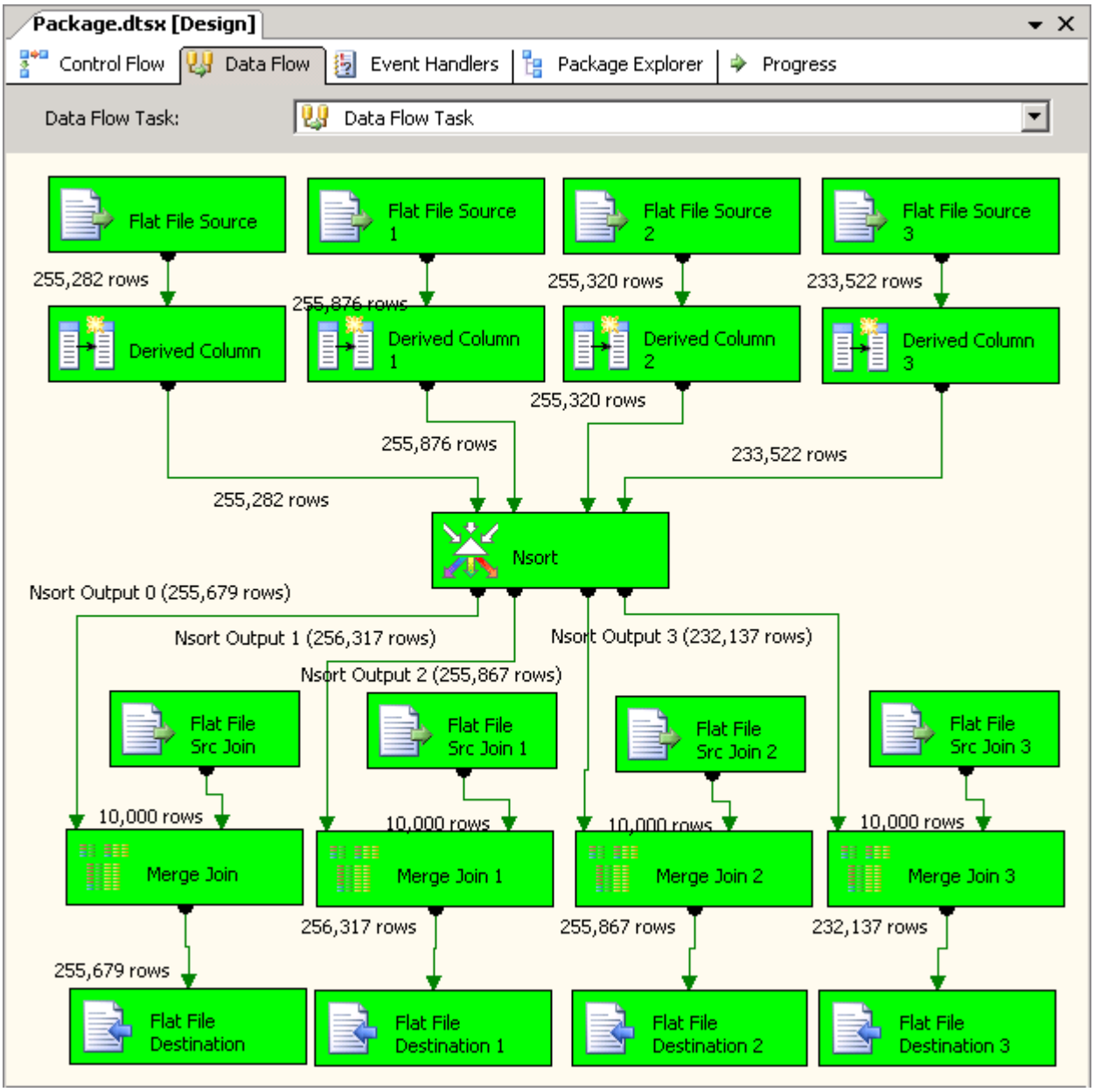
NSort can produce multiple, partitioned outputs. This facilitates the parallelism of downstream processing (e.g. Merge Join or file writing) using large numbers of CPUs or disks.

The multiple outputs are partitioned according to the first key defined for the NSort component. Currently, this first key must be either a string (**DT_STR, DT_WSTR**) or integer (**DT_I1, DT_I2, DT_I4, DT_I8, DT_UI1, DT_UI2, DT_UI4, DT_UI8**) data type.

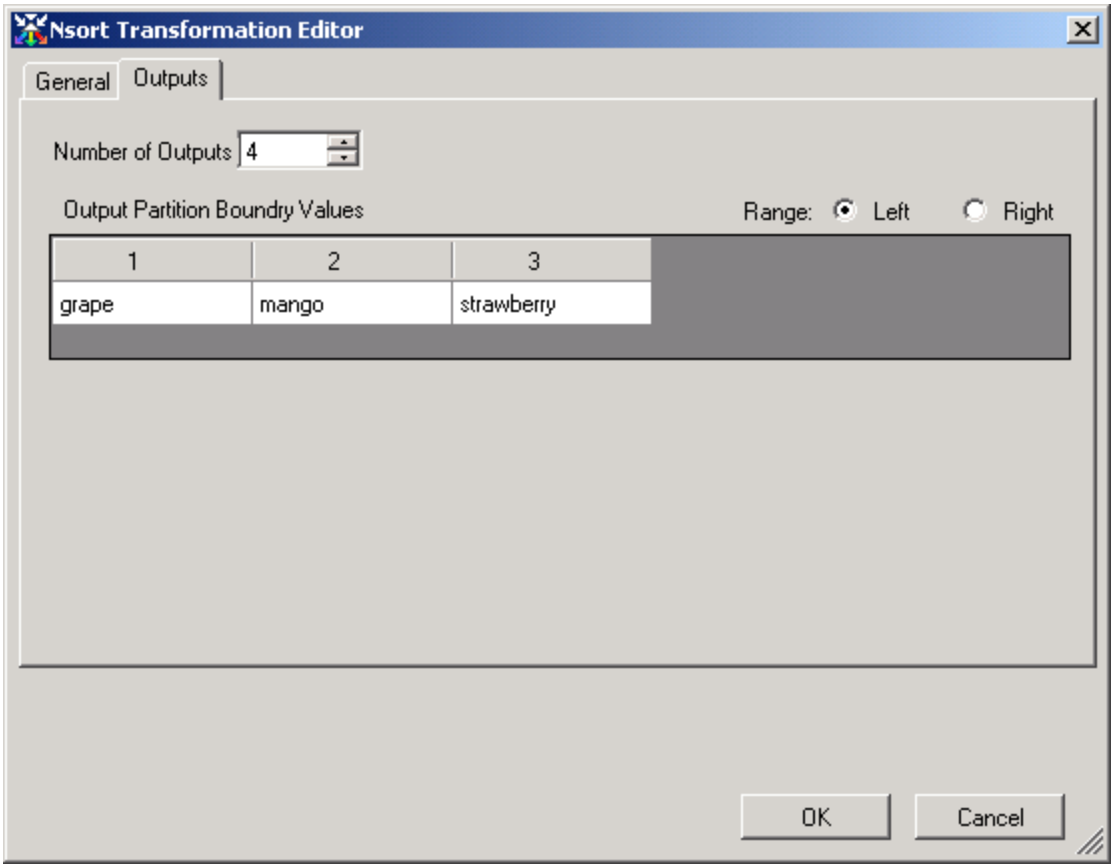
The following two screen shots were taken at the end of debug runs in the Business Intelligence Design Environment. In the first case, NSort's input consists of 1,000,000 rows which are partitioned among 4 outputs. The rows in each output are in sorted order.



The second example also sorts 1,000,000 rows, but the input rows now come from 4 different input files. In addition, *Derived Column* components transform the input streams in parallel. Likewise, the 4 output streams of NSort are transformed by *Merge Join* components.



To specify multiple outputs, click on the *Outputs* tab to view the outputs dialog:



The *Number of Outputs* box can be used to specify the output count. Partitioning must currently be specified manually by entering the partitioning key values. The first key of each row is compared to the partitioning values to determine the output for that row. Secondary keys have no effect on the output partitioning, but will affect the row order within each output.

In the above example there are 4 outputs. The three partitioning values are “grape”, “mango” and “strawberry”. *Range Left* is selected, meaning that rows with keys equal a partitioning value will go in the output to the left of partitioning value. For instance, rows whose first key is “mango” will appear at the end of the second output. If *Range Right* had been selected, these rows would appear at the beginning of the third output.

Information Events

During and after its execution, NSort raises information events that display statistics about its performance. If you run an SSIS project in Visual Studio in debug mode, NSort's information events will automatically be displayed in the *Output* window. If a project is run with *dtexec*, by default only the E (error), W (warning) and P (Progress) events are reported. To also display I (information) events for NSort and other components, the following arguments should be added to the dtexec command line: */reporting ewpi*

The NSort SSIS component utilizes the *libnsort* library, which is not specific to SSIS. The NSort component passes its unsorted input to libnsort, and receives back the rows in sorted order.

An example of NSort component information events follows, color-coded for clarity in this document. It shows:

- the input rows and bytes processed by the NSort component
- libnsort version
- amount of dtexec virtual memory used by libnsort
- input statistics for the libnsort
- temporary file write and read statistics for libnsort - only shown if temporary files(s) are actually used
- output statistics for libnsort

```
Info: 2006-01-08 16:50:12.32
   Code: 0x4020CC00
   Source: Data Flow Task NSort
   Description: Input of 380000000 rows, 39520000000 bytes processed
End Info
Info: 2006-01-08 17:15:59.54
   Code: 0x4020CC01
   Source: Data Flow Task NSort
   Description: Nsort library version 3.3.10 (Windows debug 32-bit)
End Info
Info: 2006-01-08 17:15:59.54
   Code: 0x4020CC02
   Source: Data Flow Task NSort
   Description: Usage: 319M bytes of memory
   Nsort I/O           Busy   Wait MB/sec  Xfers        Bytes        Rows
   Input                50%   2.38  33.88  37707  39520000000   380000000
   Temporary Writes
     O:\nsort_a03100    31%   0.00  33.99  75683  39538757632
   Temporary Reads
     O:\nsort_a03100    76%  47.47  25.19  75683  39538757632
   Output               99%   1517  25.08  37690  39520000000   380000000
End Info
```

Limitations

The current version of the NSort SSIS transformation has the following limitations:

- The blob column types are not supported: **DT_TEXT, DT_NTEXT, DT_IMAGE**.
- When using sort keys of type **DT_STR** and **DT_WSTR**, the temporary file data can be larger than expected.
- With multiple outputs, the first key type must be either string (**DT_STR, DT_WSTR**) or integer (**DT_I1, DT_I2, DT_I4, DT_I8, DT_UI1, DT_UI2, DT_UI4, DT_UI8**). With **DT_I8** and **DT_UI8** key types, the output partition boundry values are currently limited to those that fit in the **DT_I4** and **DT_UI4** types, respectively.
- With SSIS 2008, the DT_DBTIMESTAMPOFFEST column type cannot be used as a key, although it may be passed through the NSort component.