Santana™ Conversion Utilities Reference Manual

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Introduction

This reference manual documents the different Santana conversion programs. These conversion programs can be used to convert existing technology files (or libraries) and display files into the Santana specific formats which are used by the PyCell Studio™ product. These conversion utilities are provided to make it as easy as possible for the design engineer to adopt and deploy the PyCell Studio product in their current design flow.

There are two different conversion programs which can be used to convert existing technology and display files into Santana specific files:

- The `cntechconv` program converts an existing Cadence DF II technology file (or any OpenAccess technology library) into the Santana technology file format.
- The `cndispconv` program converts an existing Cadence DF II technology file and associated Display Resource File into the Santana technology display file format, which is used by the graphical programs.

In addition to basic information about layers (such as layer names, layer numbers and associated design rule value), the Cadence DF II technology file also contains display information which indicates how these different layers should be displayed by graphical tools. The Santana system uses two different files for all of this information. The Santana technology file does not contain any layer display information; instead, this display information is contained in a separate technology display file which is used by the graphical programs.

Note that in some cases, it might be necessary to modify the data which is generated by one or more of these conversion utilities. Since these conversion programs generate text files, a standard text editor can be used to modify the generated output. For example, one approach to creating the Santana technology file would involve using a combination of conversion utilities and text editing.

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Technology File Conversion

The `cntechconv` technology file conversion program converts existing Cadence DF II technology files into the Santana technology file format. This Cadence DF II technology file should have been created using either the CDB format or the OpenAccess format. Note that this `cntechconv` conversion program automatically supports both of these formats. This Cadence DF II technology file will be analyzed to determine which format is being used, so that the user does not need to specify this format information.

Also note that any OpenAccess technology library can also be converted by this `cntechconv` conversion program.

In addition to the required Cadence DF II technology file (or OpenAccess technology library), this `cntechconv` conversion program also provides an option to specify a mapping file. This mapping file allows the user to define a mapping between the layer names defined in the Cadence DF II technology file (or OpenAccess technology library) and the layer names used by the Santana system. In addition, this mapping file can be used to translate purposes as well as layers. If this mapping file is specified, then all of the translated layer (and purpose) names will be used in the generated Santana technology file. If this mapping file is not used, then the layer names defined in the Cadence DF II technology file (or OpenAccess library) will be used for the Santana technology file. Note that this layer mapping file can also be used to perform layer name conversion for an existing Santana technology file. This layer name mapping capability can be very useful when converting an existing Santana technology file into one which uses fixed layer names which are specific to a particular design flow (eg: `M1` is used instead of `metal1`).

cntechconv

The `cntechconv` conversion utility converts an existing Cadence DF II technology file into the Santana technology file format. This `cntechconv` conversion program can be invoked as follows:

```
cntechconv    tech-input-name [ -o   output-file-name ]
                              [ -m   mapping-file-name ]
                              [ -M   mapping-file-name ]
                              [ -f   input-format ]
                              [ -h, --help ]
                              [ -V, --version ]
```

The *tech-input-name* value is the required file path for the existing Cadence DF II technology file which should be converted to the Santana technology file format, or the name of an OpenAccess technology library. Note that this OpenAccess technology library can be any OpenAccess technology library; it does not need to be a Cadence DF technology library. Also note that this *tech-input-name* can also be the file path for a Santana technology file, when the layer name mapping capability is being used to convert layer names in an existing Santana technology file. All of the other command-line options are optional. The `-o` option is used to specify the file path for the output Santana technology file which will be generated; by default, this file is named *tech-file-name*`.converted.Santana.tech`. The `-m` and `-M` options are used to specify the file path for any mapping file which should be used during this conversion process; by default, no mapping of layers (or purposes) will take place, if neither of these options are used. Any unmapped layer or purpose names will be ignored if the `-m` option is used, while all unmapped layers and purposes will be used as is with their original names, if the `-M` option is used. Note that only one of these `-m` and `-M` command-line options can be used. The choice of technology input is determined by the use of the `-f` input format command-line option. This `-f` option is used to specify the format used by the input technology file; this option can either be `cds` for the Cadence DF II technology file, `oa` for the OpenAccess technology library, or `cni` for the Santana technology file. The `cni` option should be specified whenever the layer names in an existing Santana technology file should be converted. By default, this option is set to `cds` for the Cadence DF II technology files. The `oa` input format is used to specify that an OpenAccess technology library should be converted. The `-h` option prints out a help message, while the `-V` option prints out version information.

The mapping file can contain any of three different sections, the `layerMapping` section, the `purposeMapping` section, and the `lppMapping` section. The `layerMapping` section is used to translate between the layer names used in the input technology file, and the layer names used by the Santana system. In a similar fashion, the `purposeMapping` section is used to translate the names of purposes used in the input technology file. Likewise, the `lppMapping` section is used to translate the layer-purpose pairs (LPP) used in the input technology file. Each of these sections uses the same syntax as used for the Santana technology file; each section simply consists of a list of user layer (or purpose or LPP) names and the corresponding Santana layer (or purpose or LPP) name. It is generally not required to use such a mapping file during the conversion process. If the design group will only be using the layers (and purposes) which are defined for their own process technology, then this mapping file would not be required. However, if the design group wants to integrate PyCell™ designs (or libraries) developed externally, then this mapping file can be used to properly translate the layer names used by these other PyCell designs.

Note that when a mapping file is used during the conversion process, and the `-m` option is used, then only the layers specified in this `layerMapping` section will be used to create the layers in the output Santana technology file; any other layers in the input technology file will be ignored during the conversion process. By way of contrast, if no mapping file is provided, or a mapping file is used with the `-M` option, then all layers in the input

technology file will be used to create the layers in the generated Santana technology file. Thus, when a mapping file is specified, then the `-m` option should only be used when it is desired to ignore certain layer or purpose names in the input technology file.

The following is a sample of the information which should appear in the mapping file:

```
layerMapping(
;( Santana-name     input-name     )
;( ------------     -------------  )
 ( pwell               PWELL       )
 ( nwell               NWELL       )
 ( diff                DIFF        )
 ( od2                 THGATE      )
 ( pimp                PPLUS       )
 ( nimp                NPLUS       )
 ( poly1               POLY        )
 ( rpo                 SAB         )
 ( contact             CONT        )
 ( metal1              METAL1      )
 ( via1                VIA12       )
 ( metal2              METAL2      )
 ( via2                VIA23       )
 ( metal3              METAL3      )
 ( via3                VIA34       )
 ( metal4              METAL4      )
 ( via4                VIA45       )
 ( metal5              METAL5      )
 ( via6                VIA56       )
 ( metal6              METAL6      )
 ( via6                VIA67       )
 ( metal7              METAL7      )
 ( flightLine          FLGT        )
); layerMapping

purposeMapping(
;( Santana-name     input-name     )
;( ------------     -------------  )
 ( pin                pin          )
 ( dummy              dummy        )
); purposeMapping

lppMapping(
;( output-lpp       input-lpp )
;( --------------   ---------- )
 ( (M2DMY drawing)  (metal2 dummy) )
); lppMapping
```

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Note that these Santana layer names in this example were defined using the following conventions:

- Metal layers are specified using the layer names `metal1`, `metal2`, etc
- Via layers are specified using the names `via1`, `via2`, etc; `via1` is the via layer between `metal1` and `metal2`, while `via2` connects `metal2` and `metal3`
- Well layers are specified using the layer names `pwell` and `nwell`
- Implant layers are specified using the layer names `pimp` and `nimp`
- Thick oxide is specified using the name `od2`
- Diffusion is specified using the name `diff`
- Polysilicon is specified using the name `poly1`
- A flight line layer is specified using the name `flightLine`

Note that there is no requirement that these specific layer names be used. However, it is suggested that some naming convention be used, if multiple technology files are needed. This approach will make it easier to develop `technology independent` PyCell source code which can be directly compiled for multiple technology files.

The various constructs in the Cadence DF II technology file are converted into one or more Santana technology file constructs during this conversion process. Note that any display information contained within the input technology file will not be handled by this `cntechconv` conversion utility; this information will be ignored, but can be converted by the `cndispconv` display conversion program.

As an example, the following bullets summarize the conversion process for this `cntechconv` program, when the input technology file is a Cadence DF II CDB format technology file:

- The Santana `techId` and `viewTypeUnits` sections are generated with their default settings; no information from the input technology file is used to create these two sections of the generated output technology file
- The Santana `mfgGridResolution` information is directly created from the similarly named section of the Cadence DF II technology file
- The Santana `layerMapping` section is created using the information from the `techLayers` section of the Cadence DF II technology file, along with any optional layer information from the mapping file. Note that Santana layers are sorted by layer name, while Cadence layers are sorted by layer number.
- The Santana `derivedLayers` section is created using the information from the `techDerivedLayers` section of the Cadence DF II technology file, along with the primary layer information from the `techLayers` section.

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- The Santana `maskNumbers` section is created using the information from the `techLayers` and `layerFunctions` section of the Cadence DF II technology file, along with any optional layer information from the mapping file.
- The Santana `layerMaterials` section is created using the information from the `layerFunctions` section of the Cadence DF II technology file
- The Santana `viaLayers` section is created using the information contained in the `viaLayer` section of the Cadence DF II technology file
- The Santana `purposeMapping` section is created using the information from the `techPurposes` section of the Cadence DF II technology file, along with any optional layer information from the mapping file.
- The Santana `spacingRules` section is created using the design information from the `spacingRules` section of the Cadence DF II technology file, along with any optional layer information from the mapping file. Note that DRC commands will automatically be generated for standard design rules like `minWidth`, `minSpacing`, `minClearance`, `minOverlap`, and `minArea` design rules.
- The Santana `orderedSpacingRules` section is created using the design information from the `orderedSpacingRules` section of the Cadence DF II technology file, along with any optional layer information from the mapping file. Note that DRC commands will automatically be generated for standard design rules like `minExtension` and `minEnclosure` design rules.

Example:

```
# use default values for all command-line options
cntechconv  cdstech.tech
# use mapping file to translate layer names
cntechconv  cdstech.tech  -m  mapfile
# specify output file name for converted technology file cntechconv
 cdstech.tech  -o Santana.tech
# specify output file name and use mapping file
cntechconv cdstech.tech -m mapfile  -o Santana.tech
# convert an existing OpenAccess technology library
cntechconv techLibName -f oa
```

3

Display File Conversion

The `cndispconv` technology display file conversion program converts an existing Cadence DF II technology file and Display Resource file into the equivalent Santana file formats. That is, the display information contained within the existing Cadence DF II technology file will be converted into the equivalent Santana technology display file, and the Cadence DF II Display Resource file (.drf file) will be converted into the equivalent Santana Display Resource file.

In addition to the required Cadence DF II technology file and Display Resource file, this `cndispconv` conversion program also requires that the Santana technology file be used as part of the conversion process. The information in this Santana technology file will be combined with the information found in the required Cadence DF II technology file to generate the output Santana technology display file.

cndispconv

The `cndispconv` conversion utility converts the display information contained in an existing Cadence DF II technology file and Cadence DF II Display Resource file into the equivalent Santana file formats. This `cndispconv` conversion program can be invoked as follows:

```
cndispconv    --cdstech = cds-tech-file-name
              --cdsdisplay = cds-display-file-name
              --santanatech = santana-tech-file-name
              [ -h, --help ]
              [ -V, --version ]
```

The *`cds-tech-file-name`* is the required file path for the existing Cadence DF II technology file, for which the display information contained in this file will be converted to the Santana technology display file format. The *`cds-display-file-name`* is the required file path for the Cadence DF II Display Resource file (*.drf file), which contained the detailed display information which is referenced by the display information contained in the Cadence DF II technology file. The `--santanatech` command-line option is used to specify the file path for the Santana technology file which will be used as part of the conversion process. The `-h` option prints out a help message, while the `-V` option prints out version information.

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This `cndispconv` conversion program generates two output files: 1) the Santana technology display file and 2) the Santana display resource file. Note that these two output files have fixed file names. The Santana technology display file is named `SantanaDisplay.tech` and the Santana display resource file is named `SantanaDisplay.drf`.

The various display constructs in the Cadence DF II technology file are converted into one or more Santana technology display file constructs during this conversion process. Note that any non-display information contained within the input technology file will not be handled by this `cndispconv` conversion utility; this information is ignored, but can be converted by the `cntechconv` technology file conversion program.

Note that the Santana technology display file only consists of a single section, the `dispLayerPurposePairs` section. This single section is generated using the information from the `techDisplays` section of the Cadence DF II technology file, along with the information from the Santana technology file. Note that only the Visibility and Selectability field options from each line of the `techDisplays` section will be used in this conversion process; all other option fields will be ignored and discarded during the conversion process.

The different display resource constructs in the Cadence DF II display resource file are converted into equivalent Santana display resource file constructs during this conversion process. In almost all of these cases, the conversion process is a direct conversion process, where constructs in one format are directly mapped to the same constructs in the converted file format, as briefly summarized below:

- The Santana `dispDefineColor` section is generated using the information from the `drDefineColor` section of the Cadence DF II display resource file. Note however, that the "blink" field option from each line of the `drDefineColor` section will be ignored and unused during the conversion process.
- The Santana `dispDefineDisplay` section is generated using the information from the `drDefineDisplay` section of the Cadence DF II display resource file. The name of the display will be used in the converted Santana display resource file.
- The Santana `dispDefineStipple` section is generated using the information from the `drDefineStipple` section of the Cadence DF II display resource file.
- The Santana `dispDefineLineStyle` section is generated using the information from the `drDefineLineStyle` section of the Cadence DF II display resource file.
- The Santana `dispDefinePacket` section is generated using the information from the `drDefinePacket` section of the Cadence DF II display resource file. Note however, that the generated Santana display resource will include a `blink` field option for each line of this section, which will be set to `f` for a False value.

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Example:

```
# standard command-line usage
cndispconv  --cdstech=cds.tech --cdsdisplay=display.drf
            --santanatech=santana.tech
```