

# LanguageManual Types

## Hive Data Types

- [Hive Data Types](#)
  - [Overview](#)
    - [Numeric Types](#)
    - [Date/Time Types](#)
    - [String Types](#)
    - [Misc Types](#)
    - [Complex Types](#)
  - [Column Types](#)
    - [Integral Types \(TINYINT, SMALLINT, INT/INTEGER, BIGINT\)](#)
    - [Strings](#)
    - [Varchar](#)
    - [Char](#)
    - [Timestamps](#)
      - [Casting Dates](#)
    - [Intervals](#)
    - [Decimals](#)
      - [Decimal Literals](#)
      - [Decimal Type Incompatibilities between Hive 0.12.0 and 0.13.0](#)
        - [Upgrading Pre-Hive 0.13.0 Decimal Columns](#)
    - [Union Types](#)
  - [Literals](#)
    - [Floating Point Types](#)
      - [Decimal Types](#)
        - [Using Decimal Types](#)
        - [Mathematical UDFs](#)
        - [Casting Decimal Values](#)
        - [Testing Decimal Types](#)
  - [Handling of NULL Values](#)
  - [Change Types](#)
  - [Allowed Implicit Conversions](#)

## Overview

This lists all supported data types in Hive. See [Type System](#) in the [Tutorial](#) for additional information.

For data types supported by HCatalog, see:

- [HCatLoader Data Types](#)
- [HCatStorer Data Types](#)
- [HCatRecord Data Types](#)

## Numeric Types

- [TINYINT](#) (1-byte signed integer, from -128 to 127)
- [SMALLINT](#) (2-byte signed integer, from -32,768 to 32,767)
- [INT/INTEGER](#) (4-byte signed integer, from -2,147,483,648 to 2,147,483,647)
- [BIGINT](#) (8-byte signed integer, from -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807)
- [FLOAT](#) (4-byte single precision floating point number)
- [DOUBLE](#) (8-byte double precision floating point number)
- [DOUBLE PRECISION](#) (alias for [DOUBLE](#), only available starting with Hive [2.2.0](#))
- [DECIMAL](#)
  - Introduced in Hive [0.11.0](#) with a precision of 38 digits
  - Hive [0.13.0](#) introduced user-definable precision and scale
- [NUMERIC](#) (same as [DECIMAL](#), starting with [Hive 3.0.0](#))

## Date/Time Types

- [TIMESTAMP](#) (Note: Only available starting with Hive [0.8.0](#))
- [DATE](#) (Note: Only available starting with Hive [0.12.0](#))
- [INTERVAL](#) (Note: Only available starting with Hive [1.2.0](#))

## String Types

- [STRING](#)
- [VARCHAR](#) (Note: Only available starting with Hive [0.12.0](#))
- [CHAR](#) (Note: Only available starting with Hive [0.13.0](#))

## Misc Types

- `BOOLEAN`
- `BINARY` (Note: Only available starting with Hive [0.8.0](#))

## Complex Types

- arrays: `ARRAY<data_type>` (Note: negative values and non-constant expressions are allowed as of [Hive 0.14.](#))
- maps: `MAP<primitive_type, data_type>` (Note: negative values and non-constant expressions are allowed as of [Hive 0.14.](#))
- structs: `STRUCT<col_name : data_type [COMMENT col_comment], ...>`
- union: `UNIONTYPE<data_type, data_type, ...>` (Note: Only available starting with Hive [0.7.0.](#))

## Column Types

### Integral Types (`TINYINT`, `SMALLINT`, `INT/INTEGER`, `BIGINT`)

Integral literals are assumed to be `INT` by default, unless the number exceeds the range of `INT` in which case it is interpreted as a `BIGINT`, or if one of the following postfixes is present on the number.

Type	Postfix	Example
<code>TINYINT</code>	<code>Y</code>	<code>100Y</code>
<code>SMALLINT</code>	<code>S</code>	<code>100S</code>
<code>BIGINT</code>	<code>L</code>	<code>100L</code>

Version



`INTEGER` is introduced as a synonym for `INT` in Hive 2.2.0 ([HIVE-14950](#)).

## Strings

String literals can be expressed with either single quotes (`'`) or double quotes (`"`). Hive uses C-style escaping within the strings.

## Varchar

Varchar types are created with a length specifier (between 1 and 65535), which defines the maximum number of characters allowed in the character string. If a string value being converted/assigned to a varchar value exceeds the length specifier, the string is silently truncated. Character length is determined by the number of code points contained by the character string.

Like string, trailing whitespace is significant in varchar and will affect comparison results.

Limitations



Non-generic UDFs cannot directly use varchar type as input arguments or return values. String UDFs can be created instead, and the varchar values will be converted to strings and passed to the UDF. To use varchar arguments directly or to return varchar values, create a `GenericUDF`.

There may be other contexts which do not support varchar, if they rely on reflection-based methods for retrieving type information. This includes some SerDe implementations.

Version



Varchar datatype was introduced in Hive 0.12.0 ([HIVE-4844](#)).

## Char

Char types are similar to Varchar but they are fixed-length meaning that values shorter than the specified length value are padded with spaces but trailing spaces are not important during comparisons. The maximum length is fixed at 255.

```
CREATE TABLE foo (bar CHAR(10))
```

Version



Char datatype was introduced in Hive 0.13.0 ([HIVE-5191](#)).

## Timestamps

Supports traditional UNIX timestamp with optional nanosecond precision.

Supported conversions:

- Integer numeric types: Interpreted as UNIX timestamp in seconds
- Floating point numeric types: Interpreted as UNIX timestamp in seconds with decimal precision
- Strings: JDBC compliant java.sql.Timestamp format "YYYY-MM-DD HH:MM:SS.ffffffff" (9 decimal place precision)

Timestamps are interpreted to be timezoneless and stored as an offset from the UNIX epoch. Convenience [UDFs](#) for conversion to and from timezones are provided (`to_utc_timestamp`, `from_utc_timestamp`).

All existing datetime [UDFs](#) (month, day, year, hour, etc.) work with the `TIMESTAMP` data type.

Timestamps in text files have to use the format `yyyy-mm-dd hh:mm:ss[.f...]`. If they are in another format, declare them as the appropriate type (`INT`, `FLOAT`, `STRING`, etc.) and use a UDF to convert them to timestamps.

On the table level, alternative timestamp formats can be supported by providing the format to the [SerDe property](#) "timestamp.formats" (as of release 1.2.0 with [HIVE-9298](#)). For example, `yyyy-MM-dd'T'HH:mm:ss.SSS`, `yyyy-MM-dd'T'HH:mm:ss`.

Version



Timestamps were introduced in Hive 0.8.0 ([HIVE-2272](#)).

## Dates

`DATE` values describe a particular year/month/day, in the form `YYYY--MM--DD`. For example, `DATE '2013--01--01'`. Date types do not have a time of day component. The range of values supported for the Date type is `0000--01--01` to `9999--12--31`, dependent on support by the primitive Java Date type.

Version



Dates were introduced in Hive 0.12.0 ([HIVE-4055](#)).

## Casting Dates

Date types can only be converted to/from Date, Timestamp, or String types.

Valid casts to /from Date type	Result
<code>cast(date as date)</code>	Same date value
<code>cast(timestamp as date)</code>	The year/month/day of the timestamp is determined, based on the local timezone, and returned as a date value.
<code>cast(string as date)</code>	If the string is in the form 'YYYY-MM-DD', then a date value corresponding to that year/month/day is returned. If the string value does not match this format, then NULL is returned.
<code>cast(date as timestamp)</code>	A timestamp value is generated corresponding to midnight of the year/month/day of the date value, based on the local timezone.
<code>cast(date as string)</code>	The year/month/day represented by the Date is formatted as a string in the form 'YYYY-MM-DD'.

## Intervals

Supported Interval Description	Example	Meaning	Since
Intervals of time units: SECOND / MINUTE / DAY / MONTH / YEAR	<code>INTERVAL '1' DAY</code>	an interval of 1 day(s)	Hive 1.2.0 ( <a href="#">HIVE-9792</a> ).
Year to month intervals, format: SY-M S: optional sign (+/-) Y: year count M: month count	<code>INTERVAL '1-2' YEAR TO MONTH</code>	shorthand for: <code>INTERVAL '1' YEAR + INTERVAL '2' MONTH</code>	Hive 1.2.0 ( <a href="#">HIVE-9792</a> ).
Day to second intervals, format: SD H:M:S.nnnnnn S: optional sign (+/-) D: day count H: hours M: minutes S: seconds nnnnnn: optional nanotime	<code>INTERVAL '1 2:3:4.000005' DAY</code>	shorthand for: <code>INTERVAL '1' DAY + INTERVAL '2' HOUR + INTERVAL '3' MINUTE + INTERVAL '4' SECOND + INTERVAL '5' NANO</code>	Hive 1.2.0 ( <a href="#">HIVE-9792</a> ).
Support for intervals with constant numbers	<code>INTERVAL 1 DAY</code>	aids query readability / portability	Hive 2.2.0 ( <a href="#">HIVE-13557</a> ).

Support for intervals with expressions: this may involve other functions/columns. The expression must return with a number (which is not floating-point) or with a string.	INTERVAL (1+dt) DAY	enables dynamic intervals	Hive 2.2.0 ( <a href="#">HIVE-13557</a> ).
Optional usage of interval keyword  the usage of the INTERVAL keyword is mandatory for intervals with expressions (ex: INTERVAL (1+dt) SECOND)	1 DAY '1-2' YEAR TO MONTH	INTERVAL 1 DAY INTERVAL '1-2' YEARS TO MONTH	Hive 2.2.0 ( <a href="#">HIVE-13557</a> ).
Add timeunit aliases to aid portability / readability:  SECONDS / MINUTES / HOURS / DAYS / WEEKS / MONTHS / YEARS	2 SECONDS	2 SECOND	Hive 2.2.0 ( <a href="#">HIVE-13557</a> ).

## Decimals

Version

 Decimal datatype was introduced in Hive 0.11.0 ([HIVE-2693](#)) and revised in Hive 0.13.0 ([HIVE-3976](#)).

NUMERIC is the same as DECIMAL as of Hive 3.0.0 ([HIVE-16764](#)).

The DECIMAL type in Hive is based on Java's [BigDecimal](#) which is used for representing immutable arbitrary precision decimal numbers in Java. All regular number operations (e.g. +, -, \*, /) and relevant UDFs (e.g. Floor, Ceil, Round, and many more) handle decimal types. You can cast to/from decimal types like you would do with other numeric types. The persistence format of the decimal type supports both scientific and non-scientific notation. Therefore, regardless of whether your dataset contains data like 4.004E+3 (scientific notation) or 4004 (non-scientific notation) or a combination of both, DECIMAL can be used for it.

- Hive 0.11 and 0.12 have the precision of the DECIMAL type fixed and limited to 38 digits.
- As of Hive 0.13 users can specify scale and precision when creating tables with the DECIMAL datatype using a DECIMAL(precision, scale) syntax. If scale is not specified, it defaults to 0 (no fractional digits). If no precision is specified, it defaults to 10.

```
CREATE TABLE foo (
  a DECIMAL, -- Defaults to decimal(10,0)
  b DECIMAL(9, 7)
)
```

For usage, see [Floating Point Types](#) in the Literals section below.

### Decimal Literals

Integral literals larger than BIGINT must be handled with Decimal(38,0). The Postfix BD is required. Example:

```
select CAST(18446744073709001000BD AS DECIMAL(38,0)) from my_table limit 1;
```

### Decimal Type Incompatibilities between Hive 0.12.0 and 0.13.0

With the changes in the Decimal data type in Hive 0.13.0, the pre-Hive 0.13.0 columns (of type "decimal") will be treated as being of type decimal (10,0). What this means is that existing data being read from these tables will be treated as 10-digit integer values, and data being written to these tables will be converted to 10-digit integer values before being written. To avoid these issues, Hive users on 0.12 or earlier with tables containing Decimal columns will be required to migrate their tables, after upgrading to Hive 0.13.0 or later.

### Upgrading Pre-Hive 0.13.0 Decimal Columns

If the user was on Hive 0.12.0 or earlier and created tables with decimal columns, they should perform the following steps on these tables **after** upgrading to Hive 0.13.0 or later.

1. Determine what precision/scale you would like to set for the decimal column in the table.
2. For each decimal column in the table, update the column definition to the desired precision/scale using the [ALTER TABLE](#) command:

```
ALTER TABLE foo CHANGE COLUMN dec_column_name dec_column_name DECIMAL(38,18);
```

3. If the table is not a partitioned table, then you are done. If the table has partitions, then go on to step 3.

```
SHOW PARTITIONS foo;

ds=2008-04-08/hr=11
ds=2008-04-08/hr=12
...
```

- Each existing partition in the table must also have its DECIMAL column changed to add the desired precision/scale.

This can be done with a single [ALTER TABLE CHANGE COLUMN](#) by using dynamic partitioning (available for ALTER TABLE CHANGE COLUMN in Hive 0.14 or later, with [HIVE-8411](#)):

```
SET hive.exec.dynamic.partition = true;

-- hive.exec.dynamic.partition needs to be set to true to enable dynamic partitioning with ALTER
PARTITION
-- This will alter all existing partitions of the table - be sure you know what you are doing!
ALTER TABLE foo PARTITION (ds, hr) CHANGE COLUMN dec_column_name dec_column_name DECIMAL(38,18);
```


Alternatively, this can be done one partition at a time using ALTER TABLE CHANGE COLUMN, by specifying one partition per statement (This is available in Hive 0.14 or later, with [HIVE-7971](#)):

```
ALTER TABLE foo PARTITION (ds='2008-04-08', hr=11) CHANGE COLUMN dec_column_name dec_column_name DECIMAL
(38,18);
ALTER TABLE foo PARTITION (ds='2008-04-08', hr=12) CHANGE COLUMN dec_column_name dec_column_name DECIMAL
(38,18);
...
```

The Decimal datatype is discussed further in [Floating Point Types](#) below.

## Union Types

UNIONTYPE support is incomplete

 The UNIONTYPE datatype was introduced in Hive 0.7.0 ([HIVE-537](#)), but full support for this type in Hive remains incomplete. Queries that reference UNIONTYPE fields in JOIN ([HIVE-2508](#)), WHERE, and GROUP BY clauses will fail, and Hive does not define syntax to extract the tag or value fields of a UNIONTYPE. This means that UNIONTYPES are effectively pass-through-only.

Union types can at any one point hold exactly one of their specified data types. You can create an instance of this type using the `create_union` UDF:

```
CREATE TABLE union_test(foo UNIONTYPE<int, double, array<string>, struct<a:int,b:string>>);
SELECT foo FROM union_test;

{0:1}
{1:2.0}
{2:["three","four"]}
{3:{"a":5,"b":"five"}}
{2:["six","seven"]}
{3:{"a":8,"b":"eight"}}
{0:9}
{1:10.0}
```

The first part in the deserialized union is the *tag* which lets us know which part of the union is being used. In this example 0 means the first data\_type from the definition which is an int and so on.

To create a union you have to provide this tag to the `create_union` UDF:

```
SELECT create_union(0, key), create_union(if(key<100, 0, 1), 2.0, value), create_union(1, "a", struct(2, "b"))
FROM src LIMIT 2;

{0:"238"}          {1:"val_238"}          {1:{"col1":2,"col2":"b"}}
{0:"86"}           {0:2.0}                {1:{"col1":2,"col2":"b"}}
```


## Literals

### Floating Point Types

Floating point literals are assumed to be DOUBLE. Scientific notation is not yet supported.

### Decimal Types

Version

 Decimal datatype was introduced in Hive 0.11.0 ([HIVE-2693](#)). See [Decimal Datatype](#) above.

NUMERIC is the same as DECIMAL as of Hive 3.0.0 ([HIVE-16764](#)).

Decimal literals provide precise values and greater range for floating point numbers than the DOUBLE type. Decimal data types store exact representations of numeric values, while DOUBLE data types store very close approximations of numeric values.

Decimal types are needed for use cases in which the (very close) approximation of a DOUBLE is insufficient, such as financial applications, equality and inequality checks, and rounding operations. They are also needed for use cases that deal with numbers outside the DOUBLE range (approximately  $-10^{308}$  to  $10^{308}$ ) or very close to zero ( $-10^{-308}$  to  $10^{-308}$ ). For a general discussion of the limits of the DOUBLE type, see the Wikipedia article [Double-precision floating-point format](#).

The precision of a Decimal type is limited to 38 digits in Hive. See [HIVE-4271](#) and [HIVE-4320](#) for comments about the reasons for choosing this limit.

## Using Decimal Types

You can create a table in Hive that uses the Decimal type with the following syntax:

```
create table decimal_1 (t decimal);
```

The table `decimal_1` is a table having one field of type decimal which is basically a Decimal value.

You can read and write values in such a table using either the LazySimpleSerDe or the LazyBinarySerDe. For example:

```
alter table decimal_1 set serde 'org.apache.hadoop.hive.serde2.lazy.LazySimpleSerDe';
```

or:

```
alter table decimal_1 set serde 'org.apache.hadoop.hive.serde2.lazy.LazyBinarySerDe';
```

You can use a cast to convert a Decimal value to any other primitive type such as a BOOLEAN. For example:

```
select cast(t as boolean) from decimal_2;
```

## Mathematical UDFs

Decimal also supports many [arithmetic operators](#), [mathematical UDFs](#) and [UDAFs](#) with the same syntax as used in the case of DOUBLE.

Basic mathematical operations that can use decimal types include:

- Positive
- Negative
- Addition
- Subtraction
- Multiplication
- Division
- Average (avg)
- Sum
- Count
- Modulus (pmod)
- Sign – [Hive 0.13.0](#) and later
- Exp – [Hive 0.13.0](#) and later
- Ln – [Hive 0.13.0](#) and later
- Log2 – [Hive 0.13.0](#) and later
- Log10 – [Hive 0.13.0](#) and later
- Log(*base*) – [Hive 0.13.0](#) and later
- Sqrt – [Hive 0.13.0](#) and later
- Sin – [Hive 0.13.0](#) and later
- Asin – [Hive 0.13.0](#) and later
- Cos – [Hive 0.13.0](#) and later
- Acos – [Hive 0.13.0](#) and later
- Tan – [Hive 0.13.0](#) and later
- Atan – [Hive 0.13.0](#) and later
- Radians – [Hive 0.13.0](#) and later
- Degrees – [Hive 0.13.0](#) and later

These rounding functions can also take decimal types:

- Floor

