

# Package dsdraw

Jander Moreira

July 18, 2023

## 1 Libraries

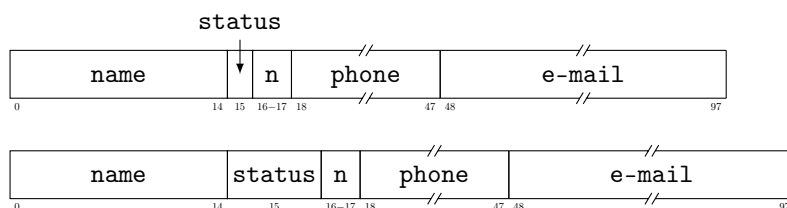
### 1.1 **record**

Drawing records and fields.

#### 1.1.1 Records and fields

Record structure with field names and byte offsets:

```
\usedslibrary{record}
\begin{tikzpicture}
  \dsrecordstructure{%
    name/15,      % 15 bytes
    status/1,     % single byte, label won't fit
    n/2,          % two bytes, label fits,
    phone/30/10,  % 30 bytes, but draws with 10
    e-mail/50/20 % 30 bytes, but draws with 20
  }
\end{tikzpicture}\par
\vspace{1em}
\begin{tikzpicture}
  \dsrecordstructure{%
    name/15,      % 15 bytes
    status/1/6,   % single byte, but draws with 6; label fits now
    n/2,          % two bytes, label fits,
    phone/30/10,  % 30 bytes, but draws with 10
    e-mail/50/20 % 30 bytes, but draws with 20
  }
\end{tikzpicture}
```



Field with contents:

```
\begin{tikzpicture}[]
  % fields must be placed inside dsrecord environments
  \begin{dsrecord}
    \dsfield{John-Taylor} % spaces must be explicit
  \end{dsrecord}
\end{tikzpicture}
```

```

\end{dsrecord}

% starred version hides outer border
\begin{dsrecord*}[][yshift = -2.5em]
\dsfield{John~Taylor}
\end{dsrecord*}

\begin{dsrecord*}[][yshift = -5em]
\dsfield*{John~Taylor} % \dsfield* is a compact version (looks ugly)
\end{dsrecord*}
\end{tikzpicture}

```

J	o	h	n		T	a	y	l	o	r
---	---	---	---	--	---	---	---	---	---	---

J	o	h	n		T	a	y	l	o	r
---	---	---	---	--	---	---	---	---	---	---

John	Taylor
------	--------

When field contents use UTF-8 encoded characters, such as “ã” and “ñ”, they are represented by their two-byte encoding in hexadecimal.

```

\begin{tikzpicture}[]
\begin{dsrecord}
\dsfield{João~Afrânio}
\end{dsrecord}
\end{tikzpicture}

\begin{tikzpicture}[]
\begin{dsrecord}
\dsfield{Jo{ã}o~Afr{â}nio}
\end{dsrecord}
\end{tikzpicture}

```

J	o	0xC3	0xA3	o		A	f	r	0xC3	0xA2	n	i	o
---	---	------	------	---	--	---	---	---	------	------	---	---	---

J	o	ã	o		A	f	r	â	n	i	o
---	---	---	---	--	---	---	---	---	---	---	---

Field with contents using a terminator (default: 0x00):

```

\begin{tikzpicture}[]
\begin{dsrecord*}
\dsfieldterminator{John~Taylor}
\end{dsrecord*}

\begin{dsrecord*}[][yshift = -2.5em]
\dsfieldterminator{John~Taylor}[*] % new terminator
\end{dsrecord*}
\end{tikzpicture}

```

J	o	h	n		T	a	y	l	o	r	0x00
---	---	---	---	--	---	---	---	---	---	---	------

J	o	h	n		T	a	y	l	o	r	*
---	---	---	---	--	---	---	---	---	---	---	---

Field with contents using binary length prefix (big endian with 2 bytes):

```

\begin{tikzpicture}[]
  \begin{dsrecord*}
    \dsfieldprefixed{John~Taylor}
  \end{dsrecord*}
\end{tikzpicture}

```

0x00	0x0B	J	o	h	n		T	a	y	l	o	r
------	------	---	---	---	---	--	---	---	---	---	---	---

Field with contents using fixed size (unused bytes are all set to 0xFF):

```

\begin{tikzpicture}[]
  \begin{dsrecord*}
    \dsfieldfixed{15}{John~Taylor}
  \end{dsrecord*}
\end{tikzpicture}

```

J	o	h	n		T	a	y	l	o	r	0xFF	0xFF	0xFF	0xFF
---	---	---	---	--	---	---	---	---	---	---	------	------	------	------

Starred field commands typeset in a compact form:

```

\begin{tikzpicture}[]
  \begin{dsrecord*}
    \dsfieldprefixed{John~Taylor}
  \end{dsrecord*}

  \begin{dsrecord*}[][yshift = -2.5em]
    \dsfieldprefixed*{John~Taylor}
  \end{dsrecord*}
\end{tikzpicture}

```

0x00	0x0B	J	o	h	n		T	a	y	l	o	r
------	------	---	---	---	---	--	---	---	---	---	---	---

0x00	0x0B	John Taylor
------	------	-------------

Records are groups of fields:

```

\begin{tikzpicture}[]
  \begin{dsrecord}
    \dsfieldprefixed*{John~Taylor} % name
    \dsfieldfixed*{2}{NY} % state
    \dsfieldfixed*{10}{08/23/1988} % birth date
  \end{dsrecord}

  \begin{dsrecord}[][yshift = -1cm]
    \dsfieldprefixed*{John~Taylor}
    \dsfieldspace
    \dsfieldfixed*{2}{NY}
    \dsfieldspace
    \dsfieldfixed*{10}{08/23/1988}
  \end{dsrecord}

  \begin{dsrecord*}[][yshift = -2cm]
    \dsfieldprefixed*{John~Taylor}
    \dsfieldspace
    \dsfieldfixed*{2}{NY}
    \dsfieldspace
  \end{dsrecord*}

```

```

\dsfieldfixed*{10}{08/23/1988}
\end{dsrecord*}
\end{tikzpicture}

```

0x00	0x00	John Taylor	NY	08/23/1988
------	------	-------------	----	------------

0x00	0x00	John Taylor	NY	08/23/1988
------	------	-------------	----	------------

0x00	0x00	John Taylor	NY	08/23/1988
------	------	-------------	----	------------

Records with terminator (default: 0x01):

```

\begin{tikzpicture}[]
\begin{dsrecord}[terminator]
\dsfieldprefixed*{John~Taylor}
\dsfieldfixed*{2}{NY}
\dsfieldfixed*{10}{08/23/1988}
\end{dsrecord}
\end{tikzpicture}

```

0x00	0x00	John Taylor	NY	08/23/1988	0x01
------	------	-------------	----	------------	------

Records with binary length prefix (little endian with 2 bytes):

```

\begin{tikzpicture}[]
\begin{dsrecord}[prefix]
\dsfieldprefixed*{John~Taylor}
\dsfieldfixed*{2}{NY}
\dsfieldfixed*{10}{08/23/1988}
\end{dsrecord}
\end{tikzpicture}

```

0x00	0x1B	0x00	0x00	John Taylor	NY	08/23/1988
------	------	------	------	-------------	----	------------

Records with fixed length (unused bytes are set to 0xFE):

```

\begin{tikzpicture}[]
\begin{dsrecord}[length = 40]
\dsfieldprefixed*{John~Taylor}
\dsfieldfixed*{2}{NY}
\dsfieldfixed*{10}{08/23/1988}
\end{dsrecord}

\begin{dsrecord}[length = 50][yshift = -1cm]
\dsfieldprefixed*{John~Taylor}
\dsfieldfixed*{2}{NY}
\dsfieldfixed*{10}{08/23/1988}
\end{dsrecord}
\end{tikzpicture}

```



```

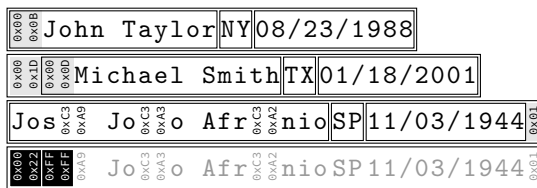
\begin{tikzpicture}
  \dsnamedrecord{record_one}{John~Taylor, NY, 08/23/1988}
\end{tikzpicture}

\begin{tikzpicture}
  \dsnamedrecord[prefix]{record_one}{Michael~Smith, TX, 01/18/2001}
\end{tikzpicture}

\begin{tikzpicture}
  \dsnamedrecord[terminator]{record_two}{José~João~Afrânio, SP, 11/03/1944}
\end{tikzpicture}

\begin{tikzpicture}
  \dsnamedrecord[deleted, terminator]{record_two}{José~João~Afrânio, SP,
    11/03/1944}
\end{tikzpicture}

```



### 1.1.2 References

A record structure can be named (default name is *record*) and each field is named *<record name>-field-*n**, starting at zero. Whenever possible, also the field names can be used.

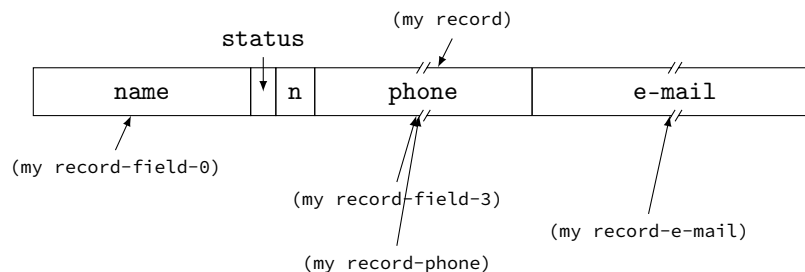
```

\usedslibrary{record}
\begin{tikzpicture}[remember picture]
  \dsrecordstructure[name = {my record}, % name a record
    hide structure offsets]{name/15, status/1, n/2, phone/30/15,
    e-mail/50/20}

  \foreach \f[count = \n] in {field-0, field-3, e-mail, phone}{
    \draw[latex-, font = \scriptsize]
      (my record-\f) -- ++(-1em, -\n * 1.2em - 1em)
      node[below] {\texttt{(my record-\f)}};
  }

  \draw[latex-, font = \scriptsize] (my record) -- ++(1em, 2em)
    node[above] {\texttt{(my record)}};
\end{tikzpicture}\par

```



Records with contents are also named and have the following labels alongside the whole record:

- Each byte is  $\langle \text{record name} \rangle\text{-byte-}n$  ( $n \geq 0$ );
- Each field is  $\langle \text{record name} \rangle\text{-field-}n$  ( $n \geq 0$ );

```

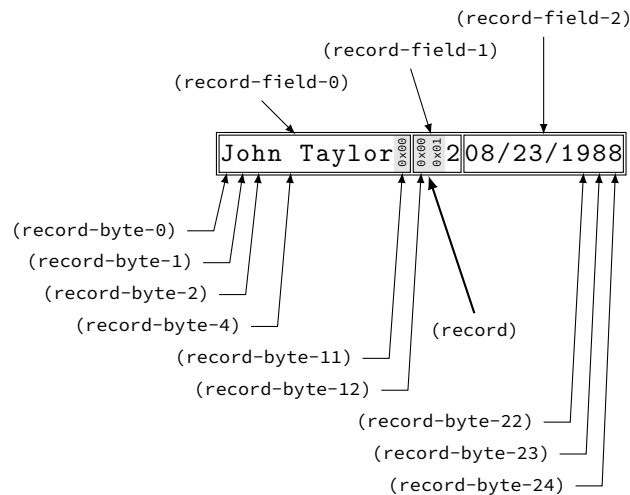
\begin{tikzpicture}
\begin{dsrecord}
\dsfieldterminator*{John~Taylor}
\dsfieldspace
\dsfieldprefixed*{2}{NY}
\dsfieldspace
\dsfieldfixed*{10}{08/23/1988}
\end{dsrecord}

\draw[latex-, thick] (record) -- ++(2em, -6em)
node[font = \scriptsize, below] {\texttt{(record)}};

\foreach \f in {0, 1, 2}{
\draw[latex-]
(record-field-\f) -- ++(\f * 1em - 2em, \f * 1.2em + 2em)
node[font = \scriptsize, above] {\texttt{(record-field-\f)}};
}

\foreach \b[count = \n] in {0, 1, 2, 4, 11, 12, 22, 23, 24}{
\draw[latex-]
(record-byte-\b.south) -- ++(-0.5em, \n * -1.2em - 1em)
-- ++(-1em, 0)
node[font = \scriptsize, below left,
anchor = east] {\texttt{(record-byte-\b)}};
}
\end{tikzpicture}

```



Some record organization bytes are also labelled (if present):

- the record terminator ( $\langle \text{record name} \rangle\text{-terminator}$ );
- the prefixed record size ( $\langle \text{record name} \rangle\text{-prefix}$ );
- the fragmentation of fixed length records ( $\langle \text{record name} \rangle\text{-fragmentation}$ ).

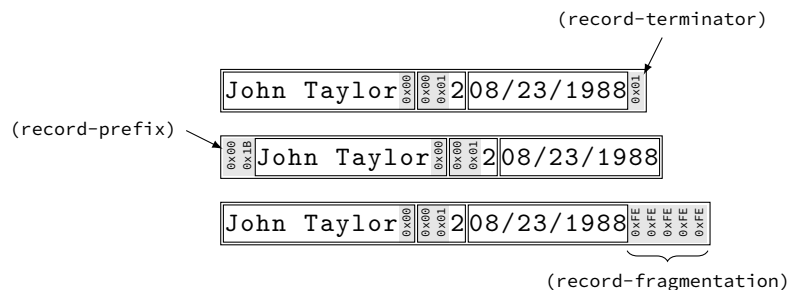
```

\begin{tikzpicture}[]
  \begin{dsrecord}[terminator]
    \dsfieldterminator*{John~Taylor}
    \dsfieldspace
    \dsfieldprefixed*{2}{NY}
    \dsfieldspace
    \dsfieldfixed*{10}{08/23/1988}
  \end{dsrecord}
  \draw[latex-, font = \scriptsize] (record-terminator) -- ++ (1em, 2em)
    node[above]{\texttt{(record-terminator)}};

  \begin{dsrecord}[prefix][yshift = -2.5em]
    \dsfieldterminator*{John~Taylor}
    \dsfieldspace
    \dsfieldprefixed*{2}{NY}
    \dsfieldspace
    \dsfieldfixed*{10}{08/23/1988}
  \end{dsrecord}
  \draw[latex-, font = \scriptsize] (record-prefix) -- ++ (-2em, 1em)
    node[left]{\texttt{(record-prefix)}};

  \begin{dsrecord}[length = 30][yshift = -5em]
    \dsfieldterminator*{John~Taylor}
    \dsfieldspace
    \dsfieldprefixed*{2}{NY}
    \dsfieldspace
    \dsfieldfixed*{10}{08/23/1988}
  \end{dsrecord}
  \draw[decorate,
    decoration = {brace, mirror, amplitude = 0.4em, raise = 0.3em}]
    (record-fragmentation.south west) --
    (record-fragmentation.south east)
    node[font = \scriptsize,
      midway, yshift = -1.5em]{\texttt{(record-fragmentation)}};
\end{tikzpicture}

```



a

## 1.2 Library **file**

The library **file** draws files and uses **record**.

### 1.2.1 Drawing files horizontally

Horizontal file with records.

```

\begin{tikzpicture}
  \dsfilestructure[block size = 4096, kbyte width = 15em,
    structure offsets
  ]{

```



```

R$_0$/500,
R$_1$/1300,
R$_2$/1800,
R$_3$/900,
R$_4$/850
}
\end{tikzpicture}

```

R <sub>0</sub>	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	
0 499 500	1799 1800	3599 3600	4499 4500	5349	8191
0		4095 4096			

### 1.2.2 Drawing files vertically

Files and records are drawn in vertical mode, one record at a time. All records must be defined with `\dsnewnamedrecord` and multiple record formats can be used. `\dsfilenamedrecord` is used to put each record.

```

\dsnewnamedrecord{fixed_length}{
  \dsfieldfixed*{12},
  \dsfieldfixed*{2},
  \dsfieldfixed*{18}
}
\dsnewnamedrecord{variable_length}{
  \dsfieldterminator*,
  \dsfieldprefixed*
}

\begin{tikzpicture}[]
  \usedslibrary{file}

  % environment for a file
  \begin{dsfile}
    \dsfilenamedrecord{fixed_length}{Grace, 22, UK}
    \dsfilenamedrecord{fixed_length}{Roberta, 31, Brazil},
    \dsfilenamedrecord{variable_length}{Karl~Ulrich, Germany},
    \dsfilenamedrecord{fixed_length}{Bethany, 34, USA}
    \dsfilenamedrecord{variable_length}{Sandoval, Chile},
  \end{dsfile}
\end{tikzpicture}

```

Grace	22	UK
Roberta	31	Brazil
Karl Ulrich	0x00 0x00 0x00	Germany
Bethany	34	USA
Sandoval	0x00 0x05	Chile

If all records share the same format, `\dsfilerecords` can be used to set records in an easier way. Both `\dsfilerecords` and `\dsfilenamedrecord` can be intermixed.

```

\dsnewnamedrecord{record}{
  \dsfieldfixed*{12},
  \dsfieldspace\dsfieldfixed*{2},
  \dsfieldspace\dsfieldfixed*{18}
}

```

```

}

\begin{tikzpicture}[]
  \begin{dsfile}[show frame, show offsets]
    \dsfilerecords{record}{
      {Grace, 22, UK},
      {Roberta, 31, Brazil},
      {Ulrich, 12, Germany},
      {Bethany, 34, USA}
    }
  \end{dsfile}
\end{tikzpicture}

```

00000000	Grace	22	UK
00000020	Roberta	31	Brazil
00000040	Ulrich	12	Germany
00000060	Bethany	34	USA

## Blocks

```

\dsnewnamedrecord{record}{
  \dsfieldfixed*{12},
  \dsfieldspace\dsfieldfixed*{2},
  \dsfieldspace\dsfieldfixed*{18}
}

\begin{tikzpicture}
  \begin{dsfile}[records = 5, show offsets]
    \begin{dsblock}{record}
      \dsfilerecords{record}{
        {Grace, 22, UK},
        {Roberta, 31, Brazil}
      }
    \end{dsblock}

    \begin{dsblock}{record}
      \dsfilerecords{record}{
        {Karl, 18, Germany},
        {Ulrich, 12, Germany},
        {Bethany, 34, USA}
      }
    \end{dsblock}
  \end{dsfile}
\end{tikzpicture}

```

00000000	Grace	22	UK	<i>bloco 0</i>
00000020	Roberta	31	Brazil	
00000040				
00000060				
00000080				
000000A0	Karl	18	Germany	<i>bloco 1</i>
000000C0	Ulrich	12	Germany	
000000E0	Bethany	34	USA	
00000100				
00000120				

### 1.2.3 References

```

\dsnewnamedrecord{record}{
  \dsfieldfixed*{15},
  \dsfieldfixed*{2},
  \dsfieldfixed*{14}
}

\begin{tikzpicture}[]
  \begin{dsfile}[hide offsets]
    \dsfilerecords{record}{
      {Grace, 22, UK},
      {Roberta~Souza, 31, Brazil/name = important},
      {Ulrich, 12, Germany},
      {Bethany, 34, USA}
    }
  \end{dsfile}

  \draw[latex-] (important.east) -- ++(3em, 3em)
    node[above, font = \scriptsize] {\texttt{(important.east)}};
  \foreach \n in {0, ..., 3}{
    \draw[latex-] (file-record-\n) -- ++(-9.5em, -\n * 1.2em + 1.5em)
      node[left, font = \scriptsize] {\texttt{(file-record-\n)}};
  }
  \draw[latex-, thick] (important-field-1) -- ++(1em, 4em)
    node[above, font = \scriptsize] {\texttt{(important-field-1)}};
  \draw[latex-, thick] (file-record-3-field-2) -- ++(-1.5em, -2em)
    node[below, font = \scriptsize] {\texttt{(file-record-3-field-2)}};
\end{tikzpicture}

```

