Package dsdraw

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1 Libraries

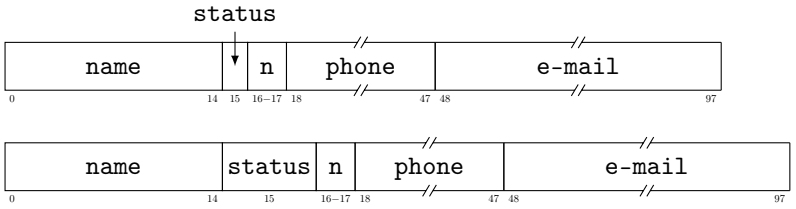
1.1 record

Drawing records and fields.

1.1.1 Records and fields

Record structure with field names and byte offsets:

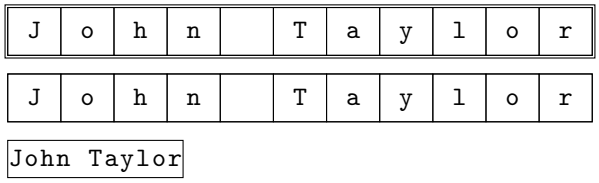
```
\usedslibrary{record}
\begin{tikzpicture}
  \dsrecordstructure{%
    name/15,       % 15 bytes
    status/1,      % single byte, label won't fit
    n/2,           % two bytes, label fits,
    phone/30/10,   % 30 bytes, but draws with 10
    e-mail/50/20   % 30 bytes, but draws with 20
  }
\end{tikzpicture}\par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

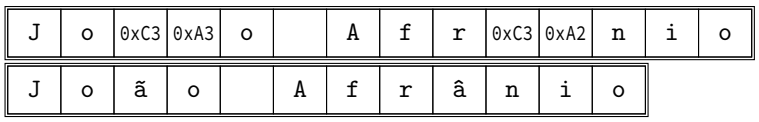
```
\begin{tikzpicture}[]
  % fields must be placed inside dsrecord environments
  \begin{dsrecord}
    \dsfield{John~Taylor} % spaces must be explicit
```

```
  \end{dsrecord}

  % 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}
```



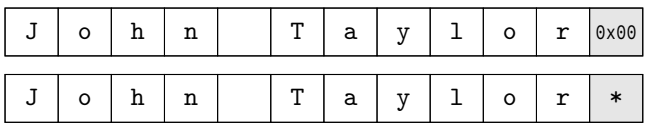
When field contents use UTF-8 encoded characters, such as “á” and “ñ”, they are represented by their two-byte encoding in hexadecimal.

```
\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}
```



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}
```

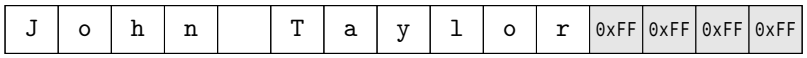


Field with contents using binary length prefix (big endian with 2 bytes):

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

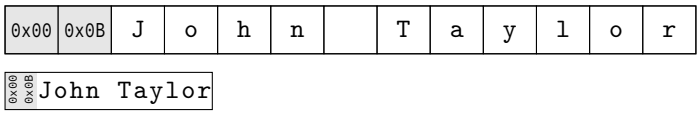
Field with contents using fixed size (unused bytes are all set to `0xFF`):

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



Starred field commands typeset in a compact form:

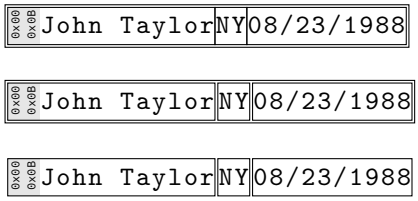
```
\begin{tikzpicture}[]
  \begin{dsrecord*}
    \dsfieldprefixed{John~Taylor}
  \end{dsrecord*}

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



Records are groups of fields:

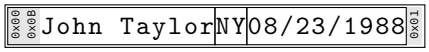
```
\begin{tikzpicture}[]
  \begin{dsrecord}
    \dsfieldprefixed*{John~Taylor}   % name
    \dsfieldfixed*{2}{NY}            % state
    \dsfieldfixed*{10}{08/23/1988}   % birth date
  \end{dsrecord}

  \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
```

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



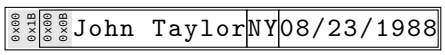
Records with terminator (default: `0x01`):

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



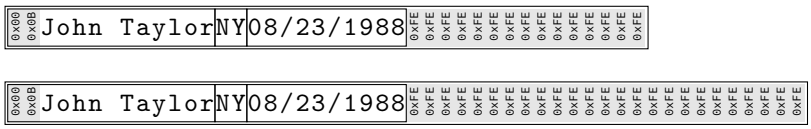
Records with binary length prefix (little endian with 2 bytes):

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



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

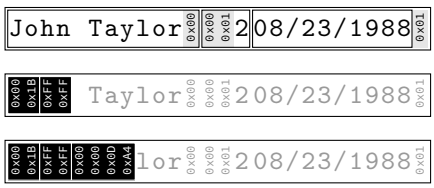
```
\begin{tikzpicture}[]
  \begin{dsrecord}[length = 40]
    \dsfieldprefixed*{John~Taylor}
    \dsfieldfixed*{2}{NY}
    \dsfieldfixed*{10}{08/23/1988}
  \end{dsrecord}

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



When a record is marked as deleted, its first eight bytes as set to:

- Two bytes to tell the total length of available space (big endian);
- The two-byte magic number `0xFFFF` that states "deleted";
- An optional four-byte address used in linked lists as a "next" field (big endian).

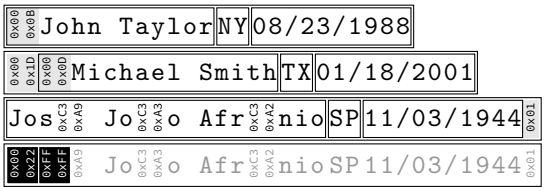
```
\begin{tikzpicture}
  \begin{dsrecord}[terminator]
    \dsfieldterminator*{John~Taylor}
    \dsfieldspace
    \dsfieldprefixed*{2}{NY}
    \dsfieldspace
    \dsfieldfixed*{10}{08/23/1988}
  \end{dsrecord}
  \begin{dsrecord}[terminator, deleted][yshift = -2.5em]
    \dsfieldterminator*{John~Taylor}
    \dsfieldspace
    \dsfieldprefixed*{2}{NY}
    \dsfieldspace
    \dsfieldfixed*{10}{08/23/1988}
  \end{dsrecord}
  \begin{dsrecord}[terminator, deleted, next = 0xDA4][yshift = -5em]
    \dsfieldterminator*{John~Taylor}
    \dsfieldspace
    \dsfieldprefixed*{2}{NY}
    \dsfieldspace
    \dsfieldfixed*{10}{08/23/1988}
  \end{dsrecord}
\end{tikzpicture}
```



To save effort, a new record structure can be defined.

```
\dsnewnamedrecord{record_one}{
  \dsfieldprefixed*,
  \dsfieldspace\dsfieldfixed*{2},
  \dsfieldspace\dsfieldfixed*{10}
}

\dsnewnamedrecord{record_two}{
  \dsfieldfixed*{20},
  \dsfieldspace\dsfieldfixed*{2},
  \dsfieldspace\dsfieldfixed*{10}
}
```

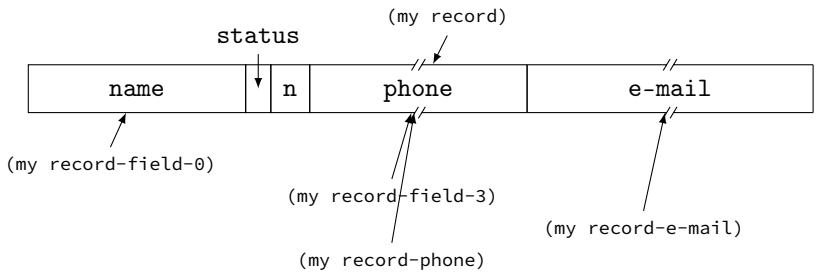
```
\begin{tikzpicture}
  \dsnamedrecord{record_one}{John~Taylor, NY, 08/23/1988}
\end{tikzpicture}

\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.

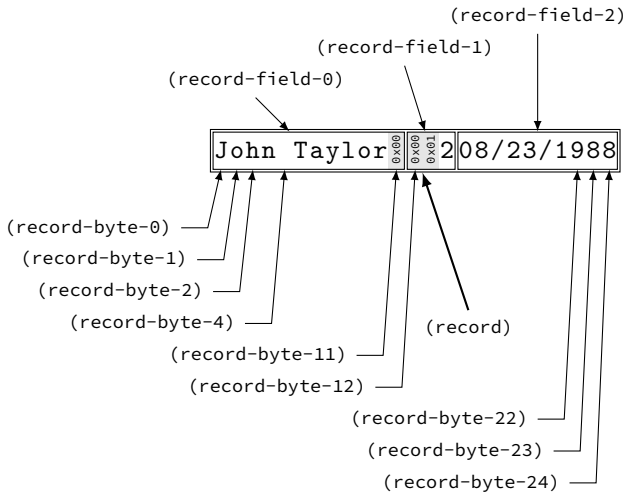
```
\usedslibrary{record}
\begin{tikzpicture}[remember picture]
  \dsrecordstructure[name = {my record}, % name a record
    hide structure offsets]{name/15, status/1, n/2, phone/30/15,
      e-mail/50/20}

  \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 ⟨*record name*⟩`-byte-`n ($n \geq 0$);
- Each field is ⟨*record name*⟩`-field-`n ($n \geq 0$);

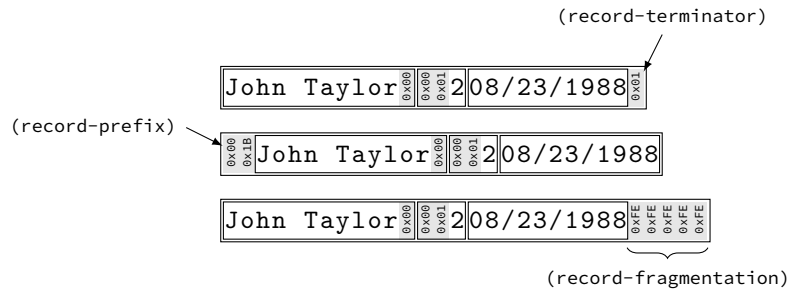
```
\begin{tikzpicture}
  \begin{dsrecord}
    \dsfieldterminator*{John~Taylor}
    \dsfieldspace
    \dsfieldprefixed*{2}{NY}
    \dsfieldspace
    \dsfieldfixed*{10}{08/23/1988}
  \end{dsrecord}

  \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 (⟨*record name*⟩`-terminator`);
- the prefixed record size (⟨*record name*⟩`-prefix`);
- the fragmentation of fixed length records (⟨*record name*⟩`-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`

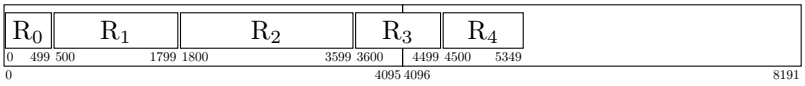
The library `file` draws files and uses `record`.

1.2.1 Drawing files horizontally

Horizontal file with records.

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

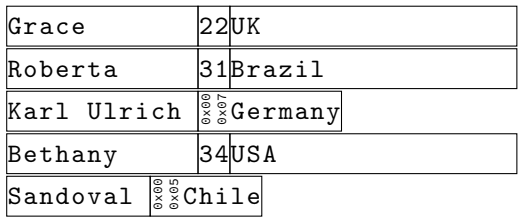
```
    R$_0$/500,
    R$_1$/1300,
    R$_2$/1800,
    R$_3$/900,
    R$_4$/850
  }
\end{tikzpicture}
```



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}
```



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.

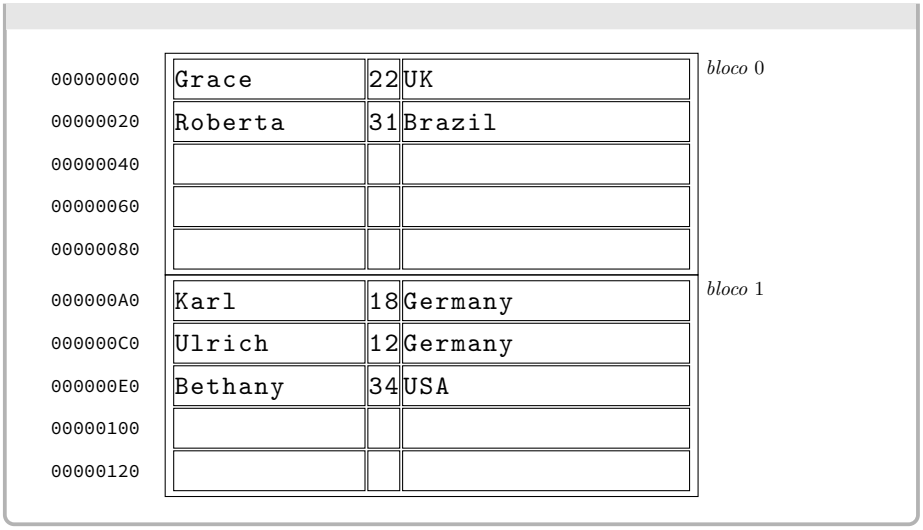
```
\dsnewnamedrecord{record}{
  \dsfieldfixed*{12},
  \dsfieldspace\dsfieldfixed*{2},
  \dsfieldspace\dsfieldfixed*{18}
```

```
}

\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}
```



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}
```