Switch to any Org LaTeX source block export backend

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1 Introduction

This document demonstrates how to switch between the four different Org LaTeX export source code block backends `verbatim`, `listings`, `minted` and `engraved`. In order to explore a bug in the `engraved` backend, the sub-backends `plain-engraved`, `fixed-engraved`, and `boxed-engraved` replace the `engraved` backend in the entry point 15.

Sub-backend `plain-engraved` selects Org upstream, sub-backend `fixed-engraved` selects a bug work-around, and sub-backend `boxed-engraved` selects a bug amplification which may lead to terrible `pdf` output.

Execution of the entry point listing 15 assumes tangling of this file to `./any-backend.el` and evaluation of `./any-backend.el` or installation of `./any-backend.el` by means of `package-install-from-buffer`.

2 LaTeX preamble with page layout and float barriers

The geometry in listing 1 makes that the line length in all listings fits within the LaTeX length `\textwidth`. Listing 1 also introduces float barriers to prevent floating figures and listings from floating outside their `[sub-][sub-]sections`.

```
1   % BEGIN: lst:latex-header
2   \usepackage{biblatex} % LaTeX compilation fails without this package.
3   % PAGE LAYOUT: https://www.overleaf.com/learn/latex/Page_size_and_margins
4   \usepackage{geometry}
5   \usepackage{layout}
6   \geometry{
7     a4paper,
8     total={480pt,680pt},
9     top=60pt,
10    left=60pt,
11  }
12  % FLOAT BARRIERS:
13  % https://tex.stackexchange.com/questions/118662/use-placeins-for-subsections
14  % Make section an implicit float barrier:
15  \usepackage[section]{placeins}
16  % Make subsection an implicit float barrier:
17  \makeatletter
18  \AtBeginDocument{%
19    \expandafter\renewcommand\expandafter\subsection\expandafter{%
20      \expandafter\@fb@secFB\subsection
21    }%
22  }
23  \makeatother
24  % Make subsubsection an implicit float barrier:
25  \makeatletter
26  \AtBeginDocument{%
27    \expandafter\renewcommand\expandafter\subsubsection\expandafter{%
28      \expandafter\@fb@secFB\subsubsection
29    }%
30  }
31  % END: lst:latex-header
```

Listing 1: LaTeX preamble with page layout and float barriers.

3 Noweb templates

Listing 2, 3, 4, 5, 6, and 7 are `noweb` templates for listing 15 and 16.

Listing 2: Noweb `plain-engraved` template.

```
1  % Backend (PLAIN) ENGRAVED requires no packages.
```

```
1  % Backend (FIXED) ENGRAVED requires no packages.
```

Listing 3: Noweb `fixed-engraved` template.

```
1  % Backend (BOXED) ENGRAVED requires no packages.
```

Listing 4: Noweb `boxed-engraved` template.

```
1  % Source block backend LISTINGS requires two packages.
2  \usepackage{listings}
3  \usepackage{color}
```

Listing 5: Noweb `listings` template.

```
1  % Backend MINTED requires one package.
2  \usepackage{minted}
```

Listing 6: Noweb `minted` template.

```
1  % Backend VERBATIM requires no packages.
```

Listing 7: Noweb `verbatim` template.

4 Switch backend and explore an `engraved` export backend bug

Listing 8, 9, 10, 11, 12, and 13, and 14 tangle into `./any-backend.el`.

```
1  ;;; any-backend.el --- demonstrate any block backend -*- lexical-binding:t -*-
2
3  ;; Author: Gerard Vermeulen <gerard.vermeulen@posteo.net>
4  ;; Version: 0.0.1
5
6  ;; This program is distributed in the hope that it will be useful,
7  ;; but WITHOUT ANY WARRANTY; without even the implied warranty of
8  ;; MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
9  ;; GNU General Public License for more details.
10
11 ;; You should have received a copy of the GNU General Public License
12 ;; along with this program.  If not, see <http://www.gnu.org/licenses/>.
13
14 ;;; Commentary:
15
16 ;; This file is the tangled output of `any-backend.org' tailored for
17 ;; use with `any-backend.el'.  Users should go to the "Export to
18 ;; LaTeX" section of `any-backend.org' and execute the `ab-do-it'
19 ;; source block after evaluation or installation of `any-backend.el'.
20
21 ;;; Code:
22
23 (require 'ox-latex)
```

Listing 8: Library file header.

```
1  (defun ab-org-babel-file-as-block-body (filename)
2    "Copy FILENAME contents to an indented Org Babel source block body."
3    (when (file-readable-p filename)
4      (let ((delete-trailing-whitespace t)
5            (n (if org-src-preserve-indentation
6                   0 org-edit-src-content-indentation)))
7        (with-temp-buffer
8          (insert-file-contents filename)
9          (string-rectangle (point-min) (point-max)
10                           (make-string n ?\s))
11         (delete-trailing-whitespace (point-min) (point-max))
12         (buffer-substring (point-min) (point-max))))))
```

Listing 9: Copy file contents to an indented source block body.

```
1  (defun ab-org-latex-engraved-source-block-filter (data _backend _info)
2    "Replace \"Code\" with \"Breakable\" in non-floating DATA environments.
3
4  Set `org-latex-engraved-preamble' to define a Breakable (non-floating)
5  environment and an unbreakable Code (floating) environment."
6    (unless (string-match "^\\\\DeclareTColorBox\\[\\]{Breakable}"
7                          org-latex-engraved-preamble)
8      (user-error
9       "`org-latex-engraved-preamble' defines no `Breakable' environment"))
10   (when (eq org-latex-src-block-backend 'engraved)
11     ;; Transform only blocks matching at position 0.  Therefore, do
12     ;; not transform blocks that are listing environments.
13     (when (string-match "\\`\\\\begin{Code}\n" data)
14         (setq data (replace-match "\\begin{Breakable}\n" t 'literal data))
15         (if (string-match "^\\\\end{Code}\n" data)
16             (setq data (replace-match "\\end{Breakable}\n" t 'literal data))
17           (error "Match `^\\\\end{Code}' failure")))))
```

Listing 10: Define a source block filter function.

```
1  (defun ab-org-latex-setup (how main)
2    "Set `org-latex-src-block-backend' and `org-latex-toc-command'.
3  HOW selects the sub-backend and MAIN selects which Org features to use."
4    (cond
5     ((memq how '(minted plain-engraved fixed-engraved boxed-engraved))
6      (setq-local
7       org-latex-toc-command
8       "\\tableofcontents\\label{toc}\n\\listoflistings\n\\newpage\n"))
9     ((eq how 'listings)
10      (setq-local
11       org-latex-toc-command
12       "\\tableofcontents\\label{toc}\n\\lstlistoflistings\n\\newpage\n"))
13     ((eq how 'verbatim)
14      (setq-local
15       org-latex-toc-command
16       "\\tableofcontents\\label{toc}\n\\listoffigures\\newpage\n"))
17     (t (user-error "Correct argument `%S' for `ab-setup'" how)))
18    (if (memq how '(plain-engraved fixed-engraved boxed-engraved))
19        (setq-local org-latex-src-block-backend 'engraved)
20      (setq-local org-latex-src-block-backend how))
21    (if main (setq-local org-latex-packages-alist nil)
22      (setq-local org-latex-packages-alist
23                  (or (and (eq how 'minted) '(("" "minted")))
24                      (and (eq how 'listings) '(("" "listings")
25                                                ("" "color")))))))
```

Listing 11: Define `ab-org-latex-setup`.

```
1  (defun ab-setup (how main)
2    "Set `org-latex-src-block-backend', `org-latex-toc-command',
3  `org-latex-engraved-preamble', and `org-export-filter-src-block-functions'.
4  HOW selects the sub-backend and MAIN selects which Org features to use."
5    (ab-org-latex-setup how main)
6    (if (memq how '(verbatim listings minted plain-engraved))
7        (progn (setq-local org-latex-engraved-preamble
8                           (default-toplevel-value 'org-latex-engraved-preamble))
9               (setq-local org-export-filter-src-block-functions nil))
10     (setq-local org-latex-engraved-preamble
11                 (format "\\usepackage{fvextra}
12  [FVEXTRA-SETUP]
13  %% Make code and line numbers normalsize. Make line numbers grey.
14  \\renewcommand\\theFancyVerbLine{
15    \\normalsize\\color{black!40!white}\\arabic{FancyVerbLine}}
16  %% Do not rely on an eventual call to `engrave-faces-latex-gen-preamble'.
17  \\usepackage{xcolor}
18  \\providecolor{EfD}{HTML}{f7f7f7}
19  \\providecolor{EFD}{HTML}{28292e}
20  %% Define a breakable Code environment to prettily wrap the fontified code.
21  \\usepackage[breakable,xparse]{tcolorbox}
22  \\DeclareTColorBox[]{Breakable}{o}{
23    colback=EfD, colframe=EFD, colupper=EFD,
24    fontupper=\\normalsize\\setlength{\\fboxsep}{0pt},
25    IfNoValueTF={#1}{
26      boxsep=2pt, arc=2.5pt, outer arc=2.5pt, boxrule=1.0pt
27    }{
28      boxsep=2.5pt, arc=0pt, outer arc=0pt, boxrule=0pt, leftrule=1.5pt
29    },
30    left=2pt, right=2pt, top=1pt, bottom=0.5pt, breakable
31  }
32  %% Define an unbreakable Code environment to fontify code inside floats.
33  \\DeclareTColorBox[]{Code}{o}{
34    colback=EfD, colframe=EFD, colupper=EFD,
35    fontupper=\\normalsize\\setlength{\\fboxsep}{0pt},
36    IfNoValueTF={#1}{
37      boxsep=2pt, arc=2.5pt, outer arc=2.5pt, boxrule=1.0pt
38    }{
39      boxsep=2.5pt, arc=0pt, outer arc=0pt, boxrule=0pt, leftrule=1pt
40    },
41    left=2pt, right=2pt, top=1pt, bottom=1pt, %s
42  }
43  [LISTINGS-SETUP]" (or (and (eq how 'fixed-engraved) "unbreakable")
44                        (and (eq how 'boxed-engraved) "breakable")
45                        (user-error "(be-setup `%S') yells BOOM!" how))))
46     (setq-local org-export-filter-src-block-functions
47                 '(ab-org-latex-engraved-source-block-filter)))
48    org-latex-src-block-backend)
```

Listing 12: Define `ab-setup`. **Line 41** depends on `how` being `fixed-engraved` or `boxed-engraved`.

```elisp
;;;###autoload
(defun ab-select-how-and-export-to-latex (main)
  "Export Org buffer to LaTeX file after prompting how to export.
In case MAIN is non-nil use org-9.7pre features, or in case MAIN is nil
use org-9.16 features, to export to LaTeX.

The `engraved' source block export backend may lead to defects in
compiled `pdf' for floating listings where vertical line spacing may not
be constant.  Option `plain-engraved' selects Org upstream, option
`fixed-engraved' selects a bug work-around, and option `boxed-engraved'
selects a bug amplification which may lead to terrible `pdf' output.
The other choices are `verbatim', `listings', and `minted' to select the
other backends."
  (interactive)
  (let ((how
          (intern-soft
           (completing-read
            "How: " '(plain-engraved fixed-engraved boxed-engraved
                                     verbatim listings minted)
            nil t)))
         (seconds 1))
     (ab-setup how main)
     (run-with-timer seconds nil #'org-latex-export-to-latex)
     (if main
         (format "#+latex_header: <<%s>>" how)
       (format "%% %s" how))))
```

Listing 13: Define `ab-select-how-and-export-to-latex`.

```elisp
(provide 'any-backend)

;;; any-backend.el ends here
```

Listing 14: Library file footer.

5 Export to LaTeX

Originally, I had written this document to explore **noweb**, but that exposed a bug fixed since 2024-02-05. Execution of the listing 15 source block uses **noweb** in case of setting ":var main='t" in this source block and execution of the listing 15 source block does not use **noweb** in case of setting ":var main='nil". The latter setting has the effect of exporting the body of listing 16.

```
1  (unless (or (featurep 'any-backend)
2              (require 'any-backend nil 'noerror))
3    (user-error "Evaluate or install `any-backend.el' (after tangling?)"))
4  (ab-select-how-and-export-to-latex main)
```

Listing 15: Call `ab-select-how-and-export-to-latex`.

```
1  % plain-engraved
```

Listing 16: Run `ab-select-how-and-export-to-latex` result.

% plain-engraved

6 Make never "broken" non-floating listing

```
1  (unless (or (featurep 'any-backend)
2              (require 'any-backend nil 'noerror))
3    (user-error "Evaluate or install `any-backend.el' (after tangling?)"))
4  (ab-org-babel-file-as-block-body filename)
```

Listing 17: Insert `any-backend.el`.

6.1 List never "broken" non-floating listing

The next non-floating listing occupies a space of more than two pages.

```
1   ;;; any-backend.el --- demonstrate any block backend -*- lexical-binding:t -*-
2
3   ;; Author: Gerard Vermeulen <gerard.vermeulen@posteo.net>
4   ;; Version: 0.0.1
5
6   ;; This program is distributed in the hope that it will be useful,
7   ;; but WITHOUT ANY WARRANTY; without even the implied warranty of
8   ;; MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
9   ;; GNU General Public License for more details.
10
11  ;; You should have received a copy of the GNU General Public License
12  ;; along with this program.  If not, see <http://www.gnu.org/licenses/>.
13
14  ;;; Commentary:
15
16  ;; This file is the tangled output of `any-backend.org' tailored for
17  ;; use with `any-backend.el'.  Users should go to the "Export to
18  ;; LaTeX" section of `any-backend.org' and execute the `ab-do-it'
19  ;; source block after evaluation or installation of `any-backend.el'.
20
21  ;;; Code:
```

```elisp
(require 'ox-latex)

(defun ab-org-babel-file-as-block-body (filename)
  "Copy FILENAME contents to an indented Org Babel source block body."
  (when (file-readable-p filename)
    (let ((delete-trailing-whitespace t)
          (n (if org-src-preserve-indentation
                 0 org-edit-src-content-indentation)))
      (with-temp-buffer
        (insert-file-contents filename)
        (string-rectangle (point-min) (point-max)
                          (make-string n ?\s))
        (delete-trailing-whitespace (point-min) (point-max))
        (buffer-substring (point-min) (point-max))))))

(defun ab-org-latex-engraved-source-block-filter (data _backend _info)
  "Replace \"Code\" with \"Breakable\" in non-floating DATA environments.

Set `org-latex-engraved-preamble' to define a Breakable (non-floating)
environment and an unbreakable Code (floating) environment."
  (unless (string-match "^\\\\DeclareTColorBox\\[\\]{Breakable}"
                        org-latex-engraved-preamble)
    (user-error
     "`org-latex-engraved-preamble' defines no `Breakable' environment"))
  (when (eq org-latex-src-block-backend 'engraved)
    ;; Transform only blocks matching at position 0.  Therefore, do
    ;; not transform blocks that are listing environments.
    (when (string-match "\\`\\\\begin{Code}\n" data)
      (setq data (replace-match "\\begin{Breakable}\n" t 'literal data))
      (if (string-match "^\\\\end{Code}\n" data)
          (setq data (replace-match "\\end{Breakable}\n" t 'literal data))
        (error "Match `^\\\\end{Code}' failure")))))

(defun ab-org-latex-setup (how main)
  "Set `org-latex-src-block-backend' and `org-latex-toc-command'.
HOW selects the sub-backend and MAIN selects which Org features to use."
  (cond
   ((memq how '(minted plain-engraved fixed-engraved boxed-engraved))
    (setq-local
     org-latex-toc-command
     "\\tableofcontents\\label{toc}\n\\listoflistings\n\\newpage\n"))
   ((eq how 'listings)
    (setq-local
     org-latex-toc-command
     "\\tableofcontents\\label{toc}\n\\lstlistoflistings\n\\newpage\n"))
   ((eq how 'verbatim)
    (setq-local
     org-latex-toc-command
     "\\tableofcontents\\label{toc}\n\\listoffigures\\newpage\n"))
   (t (user-error "Correct argument `%S' for `ab-setup'" how)))
  (if (memq how '(plain-engraved fixed-engraved boxed-engraved))
      (setq-local org-latex-src-block-backend 'engraved)
    (setq-local org-latex-src-block-backend how))
  (if main (setq-local org-latex-packages-alist nil)
    (setq-local org-latex-packages-alist
                (or (and (eq how 'minted) '(("" "minted")))
                    (and (eq how 'listings) '(("" "listings")
                                              ("" "color")))))))

(defun ab-setup (how main)
```

```
 83      "Set `org-latex-src-block-backend', `org-latex-toc-command',
 84  `org-latex-engraved-preamble', and `org-export-filter-src-block-functions'.
 85  HOW selects the sub-backend and MAIN selects which Org features to use."
 86      (ab-org-latex-setup how main)
 87      (if (memq how '(verbatim listings minted plain-engraved))
 88          (progn (setq-local org-latex-engraved-preamble
 89                             (default-toplevel-value 'org-latex-engraved-preamble))
 90                 (setq-local org-export-filter-src-block-functions nil))
 91        (setq-local org-latex-engraved-preamble
 92                    (format "\\usepackage{fvextra}
 93  [FVEXTRA-SETUP]
 94  %% Make code and line numbers normalsize. Make line numbers grey.
 95  \\renewcommand\\theFancyVerbLine{
 96    \\normalsize\\color{black!40!white}\\arabic{FancyVerbLine}}
 97  %% Do not rely on an eventual call to `engrave-faces-latex-gen-preamble'.
 98  \\usepackage{xcolor}
 99  \\providecolor{EfD}{HTML}{f7f7f7}
100  \\providecolor{EFD}{HTML}{28292e}
101  %% Define a breakable Code environment to prettily wrap the fontified code.
102  \\usepackage[breakable,xparse]{tcolorbox}
103  \\DeclareTColorBox[]{Breakable}{o}{
104    colback=EfD, colframe=EFD, colupper=EFD,
105    fontupper=\\normalsize\\setlength{\\fboxsep}{0pt},
106    IfNoValueTF={#1}{
107      boxsep=2pt, arc=2.5pt, outer arc=2.5pt, boxrule=1.0pt
108    }{
109      boxsep=2.5pt, arc=0pt, outer arc=0pt, boxrule=0pt, leftrule=1.5pt
110    },
111    left=2pt, right=2pt, top=1pt, bottom=0.5pt, breakable
112  }
113  %% Define an unbreakable Code environment to fontify code inside floats.
114  \\DeclareTColorBox[]{Code}{o}{
115    colback=EfD, colframe=EFD, colupper=EFD,
116    fontupper=\\normalsize\\setlength{\\fboxsep}{0pt},
117    IfNoValueTF={#1}{
118      boxsep=2pt, arc=2.5pt, outer arc=2.5pt, boxrule=1.0pt
119    }{
120      boxsep=2.5pt, arc=0pt, outer arc=0pt, boxrule=0pt, leftrule=1pt
121    },
122    left=2pt, right=2pt, top=1pt, bottom=1pt, %s
123  }
124  [LISTINGS-SETUP]" (or (and (eq how 'fixed-engraved) "unbreakable")
125                        (and (eq how 'boxed-engraved) "breakable")
126                        (user-error "(be-setup `%S') yells BOOM!" how))))
127      (setq-local org-export-filter-src-block-functions
128                  '(ab-org-latex-engraved-source-block-filter)))
129    org-latex-src-block-backend)
130
131  ;;;###autoload
132  (defun ab-select-how-and-export-to-latex (main)
133    "Export Org buffer to LaTeX file after prompting how to export.
134  In case MAIN is non-nil use org-9.7pre features, or in case MAIN is nil
135  use org-9.16 features, to export to LaTeX.
136
137  The `engraved' source block export backend may lead to defects in
138  compiled `pdf' for floating listings where vertical line spacing may not
139  be constant.  Option `plain-engraved' selects Org upstream, option
140  `fixed-engraved' selects a bug work-around, and option `boxed-engraved'
141  selects a bug amplification which may lead to terrible `pdf' output.
142  The other choices are `verbatim', `listings', and `minted' to select the
143  other backends."
```

```
144    (interactive)
145    (let ((how
146          (intern-soft
147          (completing-read
148          "How: " '(plain-engraved fixed-engraved boxed-engraved
149                                   verbatim listings minted)
150          nil t)))
151        (seconds 1))
152    (ab-setup how main)
153    (run-with-timer seconds nil #'org-latex-export-to-latex)
154    (if main
155        (format "#+latex_header: <<%s>>" how)
156      (format "%% %s" how))))

158 (provide 'any-backend)

160 ;;; any-backend.el ends here
```

The previous non-floating listing occupies a space of more than two pages.

7 Conclusion: summary of constraints and limitations

1. Placement of floating listings:

   - It is impossible to have more than three floating listings on a page, neither with `minted` nor with `engraved`.
   - Float barriers help to control the placement of floating listing.
   - Mixing floating and non-floating listings in the same `[sub-][sub-]section` gives visually weird results: floating listings may float between the parts of non-floating listings.

2. Table of contents:

   - the `verbatim` backend produces a "List of Figures" instead of a "List of Listings".

3. Sub-backend `plain-engraved` moving target defects:

   - Listing 2 is in a botched state.
   - Listing 10 shows too much vertical spacing after line 13.
   - Listing 11 shows too much vertical spacing after line 13.
   - Listing 12 shows too much vertical spacing after line 13, 26, and 39.
   - Listing 13 shows too much vertical spacing after line 13.

4. Sub-backend `boxed-engraved` moving target defects:

   - Listing 11 shows too much vertical spacing after line 19.
   - Listing 12 shows too much vertical spacing after line 19, and 38.
   - Listing 13 shows too much vertical spacing after line 19.

Fixing engraved requires:

1. `unbreakable` floating listings.

2. `\normalsize` font size.

3. visible boxes.

Points (2) and (3) are unacceptable, IMO.