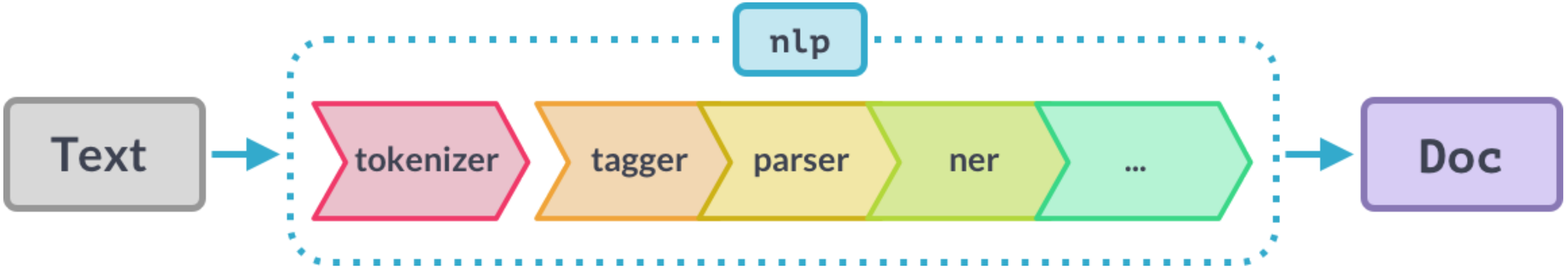
Processing pipelines

ADVANCED NLP WITH SPACY

Ines Montani
spaCy core developer

What happens when you call nlp?

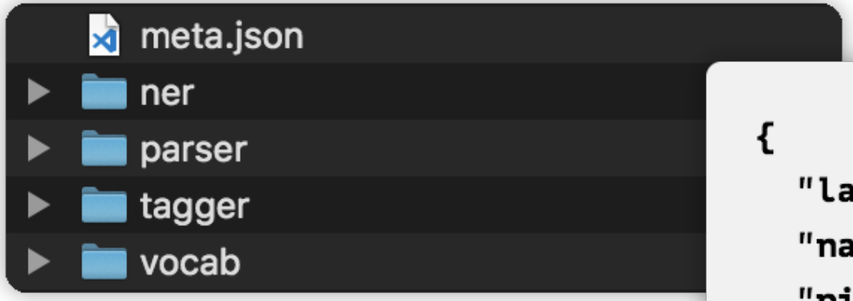



```
doc = nlp("This is a sentence.")
```

Built-in pipeline components

Name	Description	Creates
tagger	Part-of-speech tagger	`Token.tag`
parser	Dependency parser	`Token.dep` , `Token.head` , `Doc.sents` , `Doc.noun_chunks`
ner	Named entity recognizer	`Doc.ents` , `Token.ent_iob` , `Token.ent_type`
textcat	Text classifier	`Doc.cats`

Under the hood



meta.json

```
{
  "lang":"en",
  "name":"core_web_sm",
  "pipeline":["tagger", "parser", "ner"]
}
```

- Pipeline defined in model's `meta.json` in order
- Built-in components need binary data to make predictions

Pipeline attributes

- `nlp.pipe_names` : list of pipeline component names

```
print(nlp.pipe_names)
```

```
['tagger', 'parser', 'ner']
```

- `nlp.pipeline` : list of `(name, component)` tuples

```
print(nlp.pipeline)
```

```
[('tagger', <spacy.pipeline.Tagger>),
 ('parser', <spacy.pipeline.DependencyParser>),
 ('ner', <spacy.pipeline.EntityRecognizer>)]
```

Let's practice!

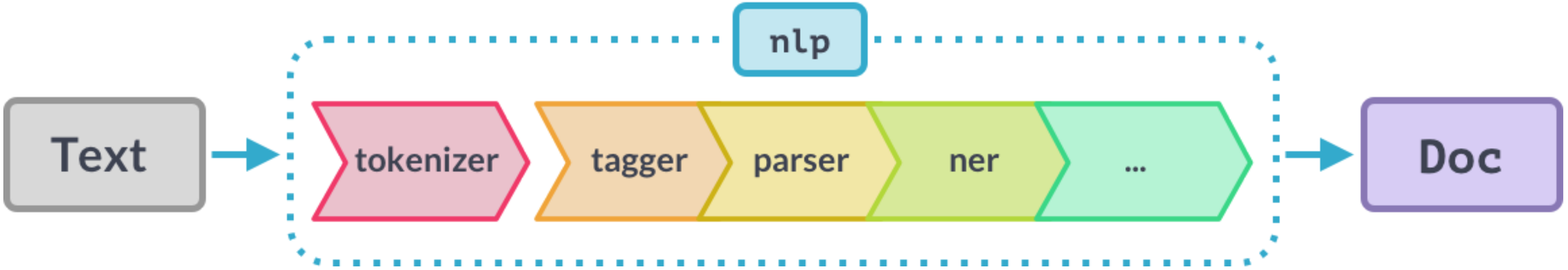
ADVANCED NLP WITH SPACY

Custom pipeline components

ADVANCED NLP WITH SPACY

Ines Montani
spaCy core developer

Why custom components?



- Make a function execute automatically when you call `nlp`
- Add your own metadata to documents and tokens
- Updating built-in attributes like `doc.ents`

Anatomy of a component (1)

- Function that takes a `doc`, modifies it and returns it
- Can be added using the `nlp.add_pipe` method

```
def custom_component(doc):
    # Do something to the doc here
    return doc
nlp.add_pipe(custom_component)
```

Anatomy of a component (2)

```
def custom_component(doc):
    # Do something to the doc here
    return doc

nlp.add_pipe(custom_component)
```

Argument	Description	Example
`last`	If `True`, add last	`nlp.add_pipe(component, last=True)`
`first`	If `True`, add first	`nlp.add_pipe(component, first=True)`
`before`	Add before component	`nlp.add_pipe(component, before='ner')`
`after`	Add after component	`nlp.add_pipe(component, after='tagger')`

Example: a simple component (1)

```
# Create the nlp object
nlp = spacy.load('en_core_web_sm')
# Define a custom component
def custom_component(doc):
    # Print the doc's length
    print('Doc length:' len(doc))
    # Return the doc object
    return doc
# Add the component first in the pipeline
nlp.add_pipe(custom_component, first=True)
# Print the pipeline component names
print('Pipeline:', nlp.pipe_names)
```

```
Pipeline: ['custom_component', 'tagger', 'parser', 'ner']
```

Example: a simple component (2)

```
# Create the nlp object
nlp = spacy.load('en_core_web_sm')

# Define a custom component
def custom_component(doc):

    # Print the doc's length
    print('Doc length:' len(doc))

    # Return the doc object
    return doc

# Add the component first in the pipeline
nlp.add_pipe(custom_component, first=True)
# Process a text
doc = nlp("Hello world!")
```

```
Doc length: 3
```

Let's practice!

ADVANCED NLP WITH SPACY

Extension attributes

ADVANCED NLP WITH SPACY

Ines Montani
spaCy core developer

Setting custom attributes

- Add custom metadata to documents, tokens and spans
- Accessible via the `._` property

```
doc._.title = 'My document'
token._.is_color = True
span._.has_color = False
```

- registered on the global `Doc`, `Token` or `Span` using the `set_extension` method

```
# Import global classes
from spacy.tokens import Doc, Token, Span
# Set extensions on the Doc, Token and Span
Doc.set_extension('title', default=None)
Token.set_extension('is_color', default=False)
Span.set_extension('has_color', default=False)
```

Extension attribute types

1. Attribute extensions
2. Property extensions
3. Method extensions

Attribute extensions

- Set a default value that can be overwritten

```
from spacy.tokens import Token

# Set extension on the Token with default value
Token.set_extension('is_color', default=False)
doc = nlp("The sky is blue.")

# Overwrite extension attribute value
doc[3]._.is_color = True
```

Property extensions (1)

- Define a getter and an optional setter function
- Getter only called when you *retrieve* the attribute value

```
from spacy.tokens import Token

# Define getter function
def get_is_color(token):
    colors = ['red', 'yellow', 'blue']
    return token.text in colors
# Set extension on the Token with getter
Token.set_extension('is_color', getter=get_is_color)
doc = nlp("The sky is blue.")
print(doc[3]._.is_color, '-', doc[3].text)
```

```
blue - True
```

Property extensions (2)

- `Span` extensions should almost always use a getter

```
from spacy.tokens import Span

# Define getter function
def get_has_color(span):
    colors = ['red', 'yellow', 'blue']
    return any(token.text in colors for token in span)
# Set extension on the Span with getter
Span.set_extension('has_color', getter=get_has_color)
doc = nlp("The sky is blue.")
print(doc[1:4]._.has_color, '-', doc[1:4].text)
print(doc[0:2]._.has_color, '-', doc[0:2].text)
```

```
True - sky is blue
False - The sky
```

Method extensions

- Assign a **function** that becomes available as an object method
- Lets you pass **arguments** to the extension function

```
from spacy.tokens import Doc

# Define method with arguments
def has_token(doc, token_text):
    in_doc = token_text in [token.text for token in doc]
# Set extension on the Doc with method
Doc.set_extension('has_token', method=has_token)
doc = nlp("The sky is blue.")
print(doc._.has_token('blue'), '- blue')
print(doc._.has_token('cloud'), '- cloud')
```

```
True - blue
False - cloud
```

Let's practice!

ADVANCED NLP WITH SPACY

Scaling and performance

ADVANCED NLP WITH SPACY

Ines Montani
spaCy core developer

Processing large volumes of text

- Use `nlp.pipe` method
- Processes texts as a stream, yields `Doc` objects
- Much faster than calling `nlp` on each text

BAD:

```
docs = [nlp(text) for text in LOTS_OF_TEXTS]
```

GOOD:

```
docs = list(nlp.pipe(LOTS_OF_TEXTS))
```

Passing in context (1)

- Setting `as_tuples=True` on `nlp.pipe` lets you pass in `(text, context)` tuples
- Yields `(doc, context)` tuples
- Useful for associating metadata with the `doc`

```
data = [
    ('This is a text', {'id': 1, 'page_number': 15}),
    ('And another text', {'id': 2, 'page_number': 16}),
]
for doc, context in nlp.pipe(data, as_tuples=True):
    print(doc.text, context['page_number'])
```

```
This is a text 15
And another text 16
```

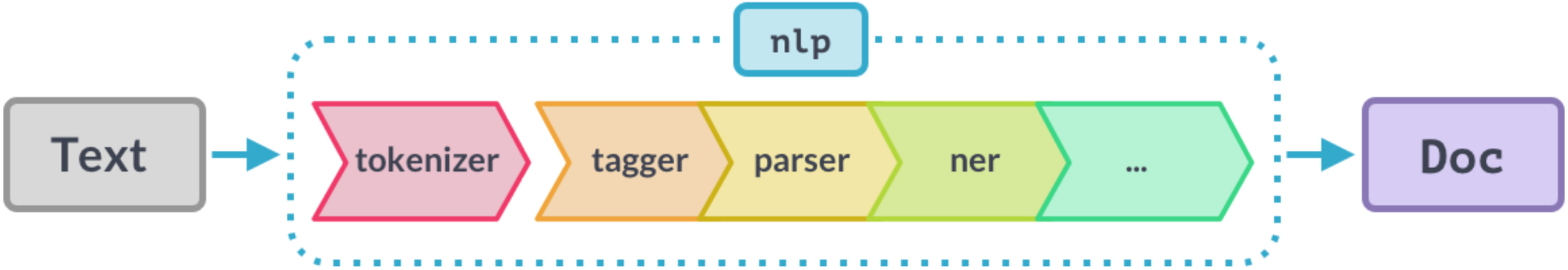
Passing in context (2)

```
from spacy.tokens import Doc

Doc.set_extension('id', default=None)
Doc.set_extension('page_number', default=None)
data = [
    ('This is a text', {'id': 1, 'page_number': 15}),
    ('And another text', {'id': 2, 'page_number': 16}),
]

for doc, context in nlp.pipe(data, as_tuples=True):
    doc._.id = context['id']
    doc._.page_number = context['page_number']
```

Using only the tokenizer



- don't run the whole pipeline!

Using only the tokenizer (2)

- Use `nlp.make_doc` to turn a text in to a `Doc` object

BAD:

```
doc = nlp("Hello world")
```

GOOD:

```
doc = nlp.make_doc("Hello world!")
```

Disabling pipeline components

- Use `nlp.disable_pipes` to temporarily disable one or more pipes

```
# Disable tagger and parser
with nlp.disable_pipes('tagger', 'parser'):
    # Process the text and print the entities
    doc = nlp(text)
    print(doc.ents)
```

- restores them after the `with` block
- only runs the remaining components

Let's practice!

ADVANCED NLP WITH SPACY