Current Developments in Tooling and Editor Support in textX

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https://langdevcon.org

Agenda

- textX
- Web Playground
- VS Code Extension
- Drone Example Demo
- Summary
- Q&A

JGBX

ProxyHands

textX

Overview, Basic Concepts & textX CLI

textX

- Meta-Language for DSL specification in Python
- Inspired by Xtext
- Project started by Igor Dejanović in 2014
- 24 contributors
- Current version – 4.0.1

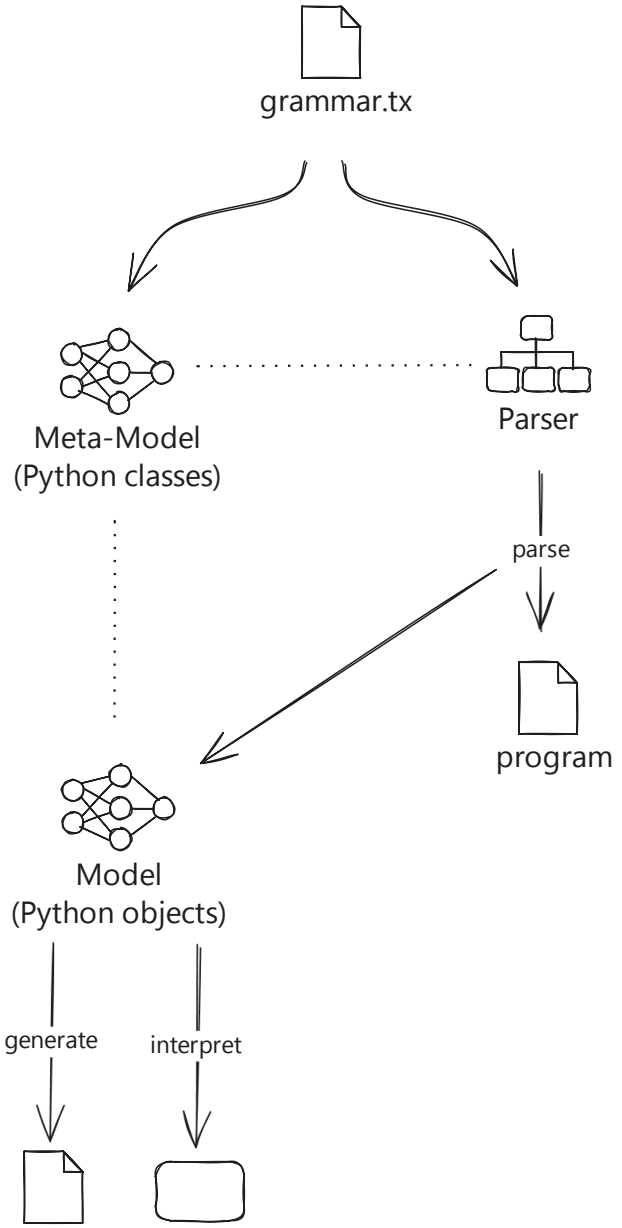
GitHub: https://github.com/textX/textX

PyPi: https://pypi.org/project/textX/

Docs: https://textx.github.io/textX

textX – Overview

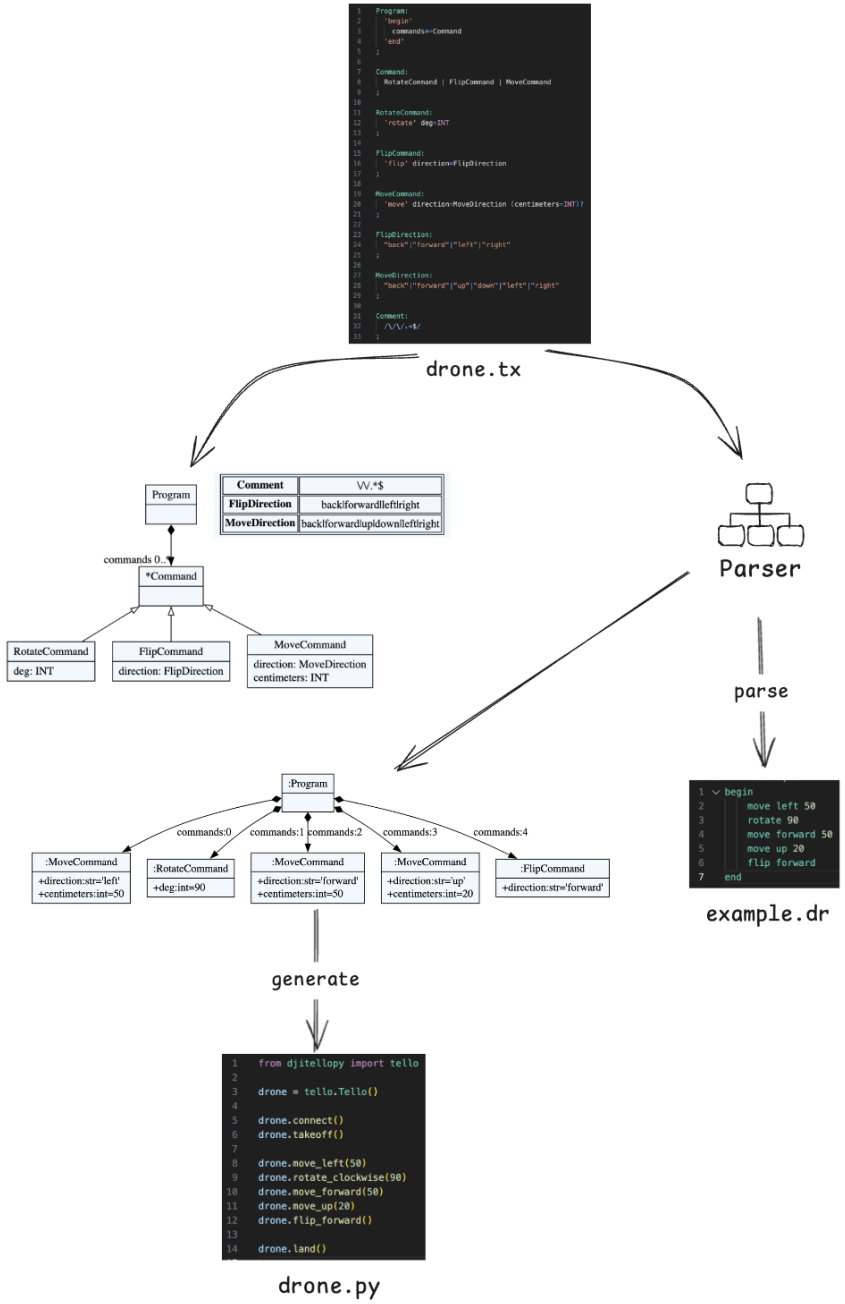
1. Meta-model and Parser are built from Grammar file
2. Parser builds Model during Program parsing
3. Generate code or interpret



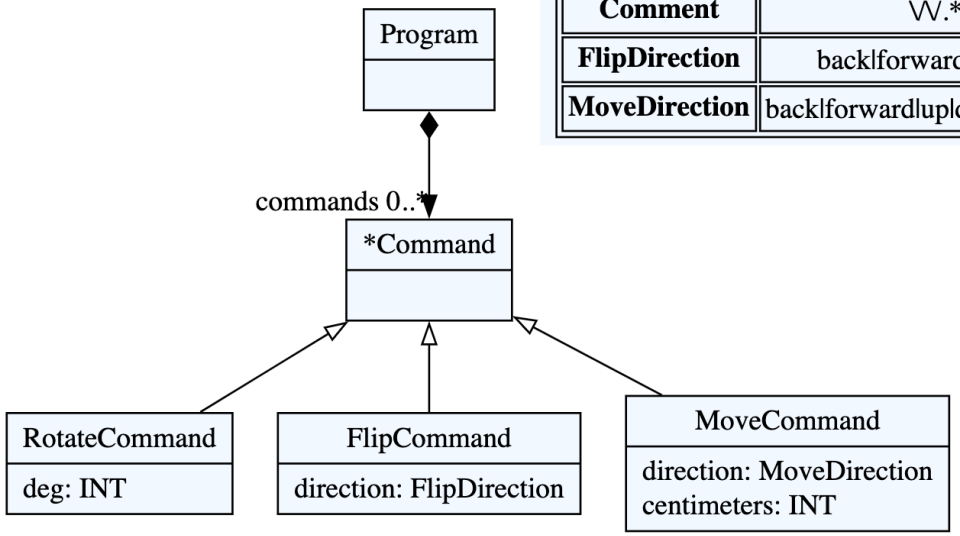
Model corresponds to Meta-model

textX – Drone Example

1. Meta-model and Parser built from the `drone.tx` grammar file
2. Parser builds Model during parsing the `example.dr` file
3. Generate executable Python code in `drone.py` file



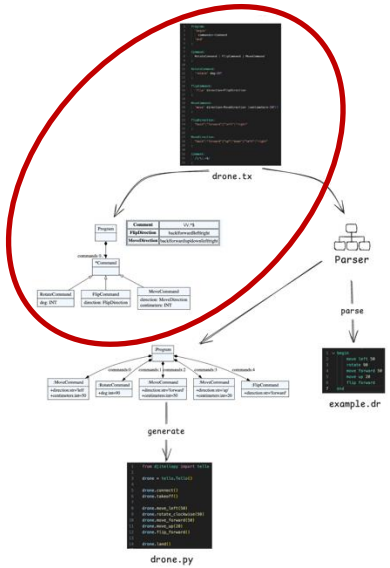
textX – Grammar and Metamodel



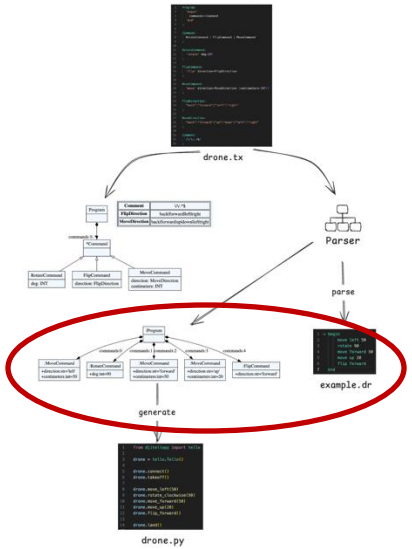
Comment	\\.*$
FlipDirection	back|forward|left|right
MoveDirection	back|forward|up|down|left|right

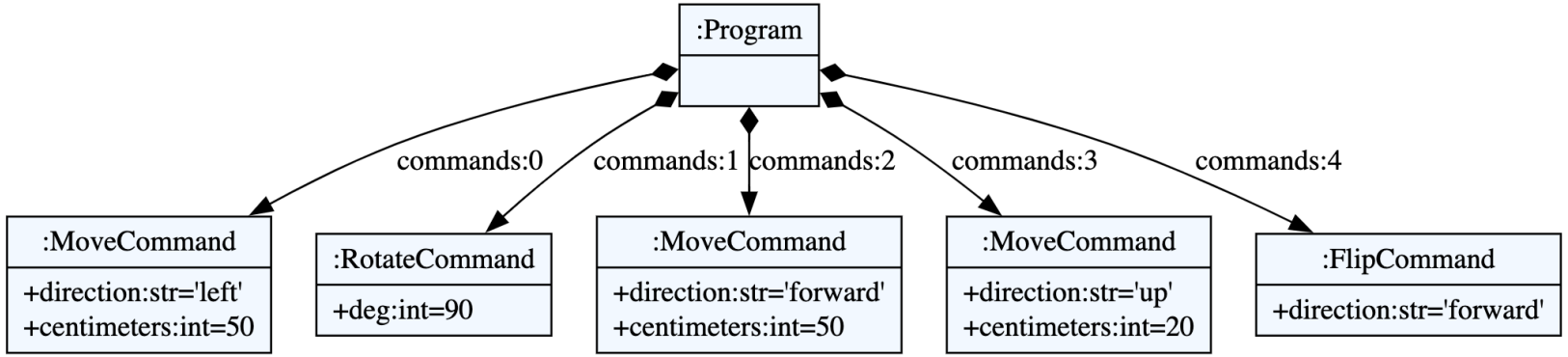
```
Program:
  'begin'
    commands*=Command
  'end'
;

Command:
  RotateCommand | FlipCommand | MoveCommand
;

RotateCommand:
  'rotate' deg=INT
;

FlipCommand:
  'flip' direction=FlipDirection
;

MoveCommand:
  'move' direction=MoveDirection (centimeters=INT)?
;

FlipDirection:
  "back"|"forward"|"left"|"right"
;

MoveDirection:
  "back"|"forward"|"up"|"down"|"left"|"right"
;

Comment:
  /\/\/.*$/
;
```

drone.tx



textX – Program and Model

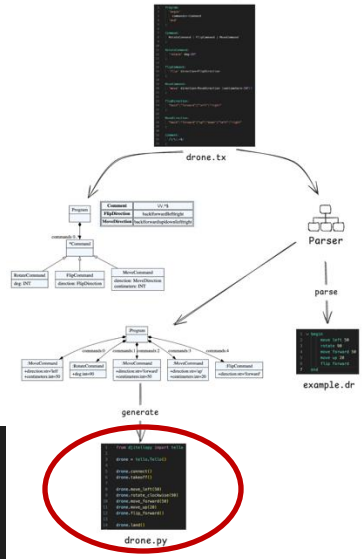





```
begin
    move left 50
    rotate 90
    move forward 50
    move up 20
    flip forward
end
```

example.dr

textX – Code Generation




```
1   from djitellopy import tello
2
3   drone = tello.Tello()
4
5   drone.connect()
6   drone.takeoff()
7
8   {% for command in commands %}
9       {% if command.__class__.__name__ == 'MoveCommand' %}
10  drone.move_{{command.direction}}({{command.centimeters}})
11      {% endif %}
12      {% if command.__class__.__name__ == 'RotateCommand' %}
13  drone.rotate_{{'clockwise' if command.deg > 0 else 'counter_clockwise'}}({{command.deg}})
14      {% endif %}
15      {% if command.__class__.__name__ == 'FlipCommand' %}
16  drone.flip_{{command.direction}}()
17      {% endif %}
18  {% endfor %}
19
20  drone.land()
```

drone.py.jinja

```
1   from djitellopy import tello
2
3   drone = tello.Tello()
4
5   drone.connect()
6   drone.takeoff()
7
8   drone.move_left(50)
9   drone.rotate_clockwise(90)
10  drone.move_forward(50)
11  drone.move_up(20)
12  drone.flip_forward()
13
14  drone.land()
```

drone.py

textX – Validation from python script

```python
from textx import metamodel_from_file

# validate metamodel
metamodel = metamodel_from_file('drone.tx')

# validate model based on metamodel
model = metamodel.model_from_file('example.dr')
```

textX – Validation from CLI

- Metamodel validation

```
textx check drone.tx
```

- Model validation
  - language not registered

```
textx check example.dr --grammar drone.tx
```

  - language registered

```
textx check example.dr
textx check example.dr --language drone
```

textX – Other CLI commands

- List registered languages

```
textx list-languages
```

- List registered generators

```
textx list-generators
```

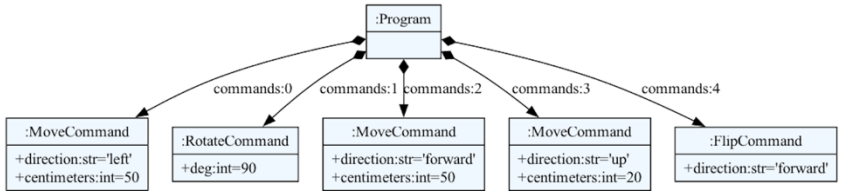
- Generate code

```
textx generate --language Drone --target python --overwrite
```

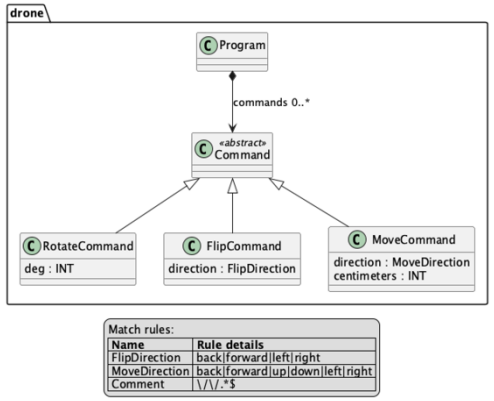
textX – Visualization

- Visualize model and metamodel

```
textx generate --grammar drone.tx --target dot example.dr
dot -Tpng -O example.dot
```




```
textx generate drone.tx --target plantuml
plantuml drone.pu
```



Web Playground

Motivation, Considerations and Solution

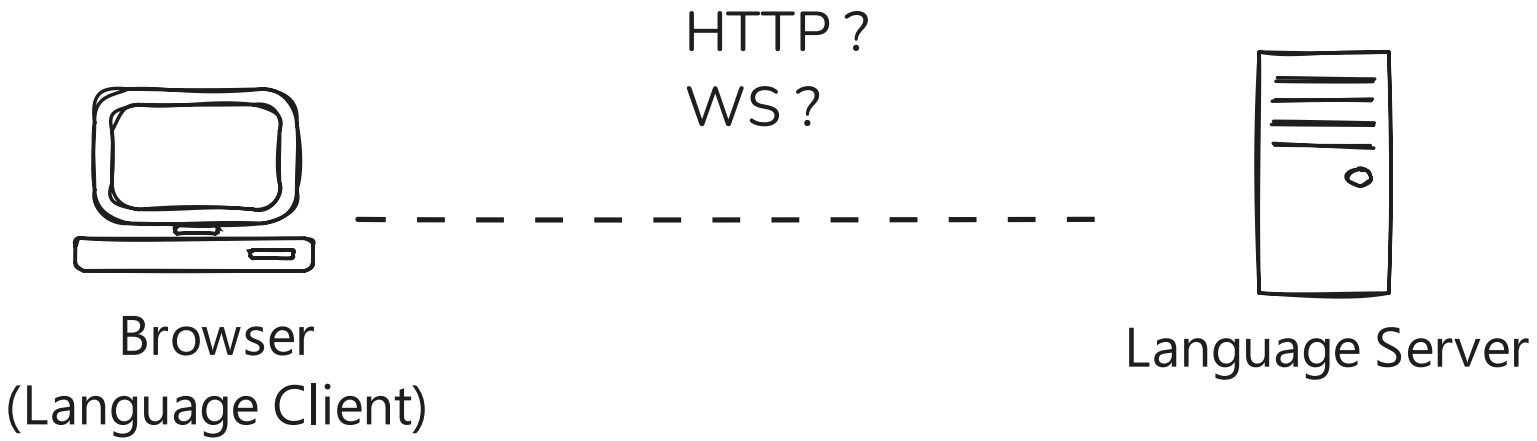
Web Playground - Motivation

- Trying textX includes:
  - Prerequisites - python and pip
  - Creating virtual env (optional)
  - Installing textX
  - Running python script or textX CLI commands

- Web Playground 💡

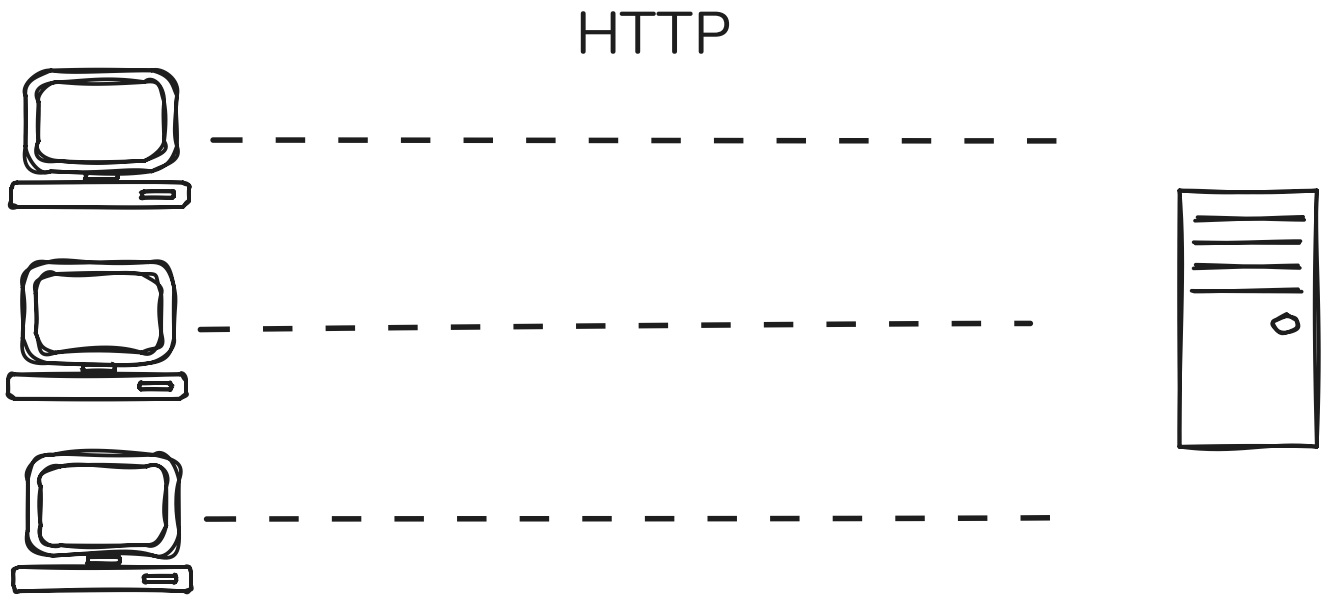
Web Playground - Considerations

- Language Client and Server architecture and communication



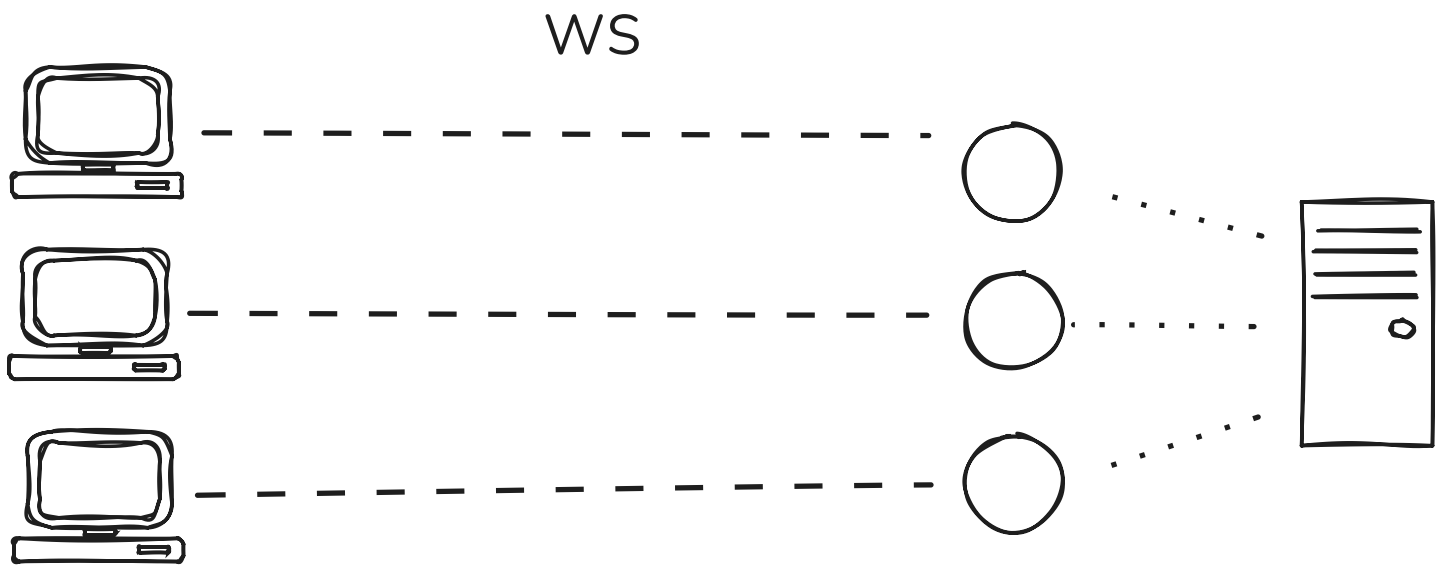
Web Playground - Considerations

- HTTP connection, manage sessions and documents state



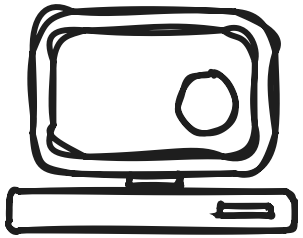
Web Playground - Considerations

- Separate process per client with WebSocket connection



Web Playground - Considerations

- Language server and client on the same machine



Download LS and run it?

Run LS in the browser?

Web Playground

- Created in 2024 by Milan Šović
- Language Server based on Pygls
- Runs in a Web Worker, using Pyodide
- Monaco editor
- Language Client based on monaco-languageclient and vscode-languageclient

Github: https://github.com/textX/textx-playground

Playground: https://textx.github.io/textx-playground

Web Playground

textX

Examples

Documentation

Language Grammar

```
Program:
  'begin'
    commands*=Command
  'end'
  ;

Command:
  RotateCommand | FlipCommand | MoveCommand
  ;

RotateCommand:
  'rotate' deg=INT
  ;

FlipCommand:
  'flip' direction=FlipDirection
  ;

MoveCommand:
  'move' direction=MoveDirection (centimeters=INT)?
  ;

FlipDirection:
  "back"|"forward"|"left"|"right"
  ;

MoveDirection:
  "back"|"forward"|"up"|"down"|"left"|"right"
  ;

Comment:
  /\/\/.*$/
  ;
```

Grammar is valid

Model (Program)

```
begin
    move left 50
    rotate 90
    move forward 50
    move up 20
    flip forward
end
```

Model is valid

Web Playground

textX

Examples

Documentation

Language Grammar

```
Program:
  'begin'
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Command:
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  "back"|"forward"|"left"|"right"
  ;

MoveDirection:
  "back"|"forward"|"up"|"down"|"left"|"right"
  ;

Comment:
  /\/\/.*$/
  ;
```

Model (Program)

```
begin
    move left 50
    rotate 90
    move forward 50
    move up 20
    flip forward
end
```

Visualize

Share

Status Bar

Grammar is valid

Model is valid

Web Playground - Features

- Grammar and Program definition with instant validation
- Basic syntax highlighting
- Grammar and Program visualization
- Light and dark theme
- Examples
- Share

Share link to Drone example

VS Code Extension

VS Code Extension

- Created by Daniel Elero in 2018
- Contains:
  - textX Language Server (based on Pygls)
  - VS Code Extension

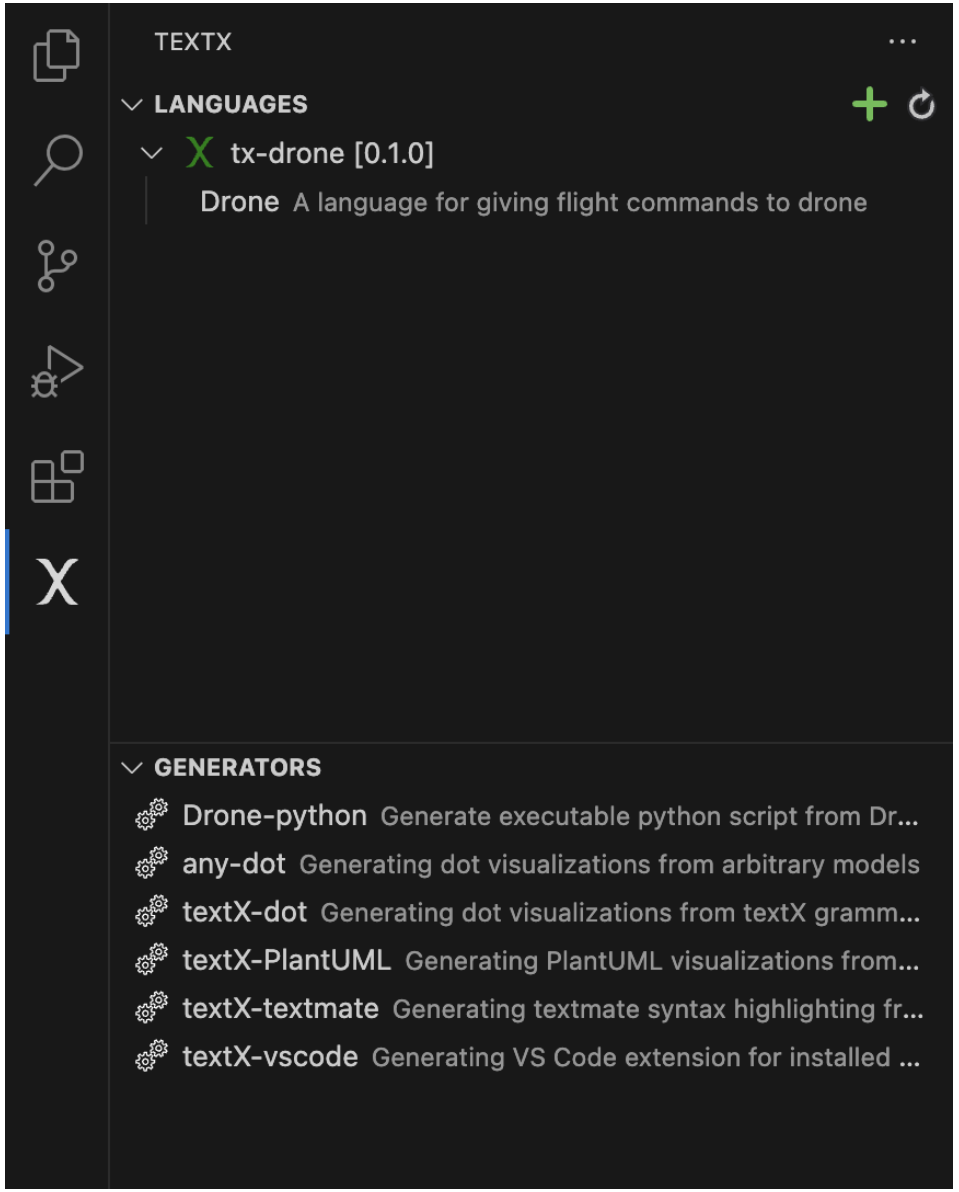
Github: https://github.com/textX/textX-LS

PyPi: https://pypi.org/project/textx-ls-server/

VS Code Marketplace:
https://marketplace.visualstudio.com/items?itemName=textX.textX

VS Code Extension – Sidebar

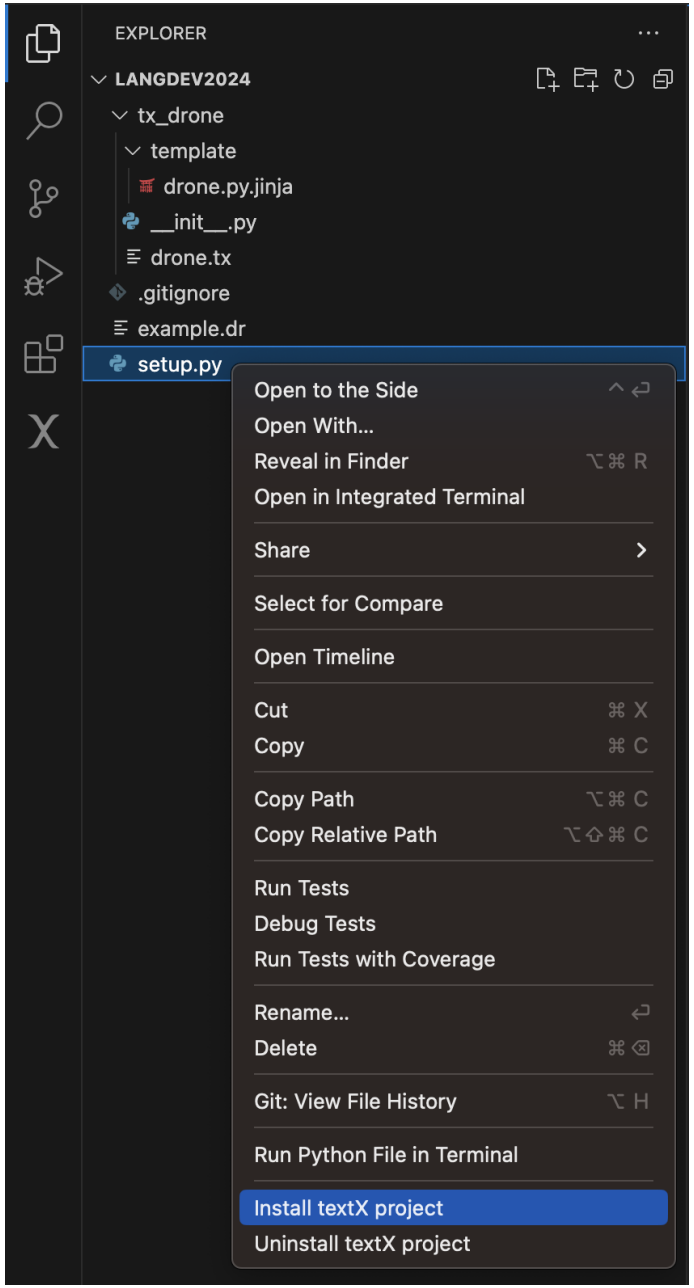
- Project installation from wheel file
- Show and Refresh projects with registered languages
- Show registered generators



VS Code Extension

- Project installation from python package configuration file
- It will be installed in extension's virtual environment

```
textx-ls-core      0.2.0
textx-ls-server    0.2.0
tx-drone           0.1.0
```



VS Code Extension

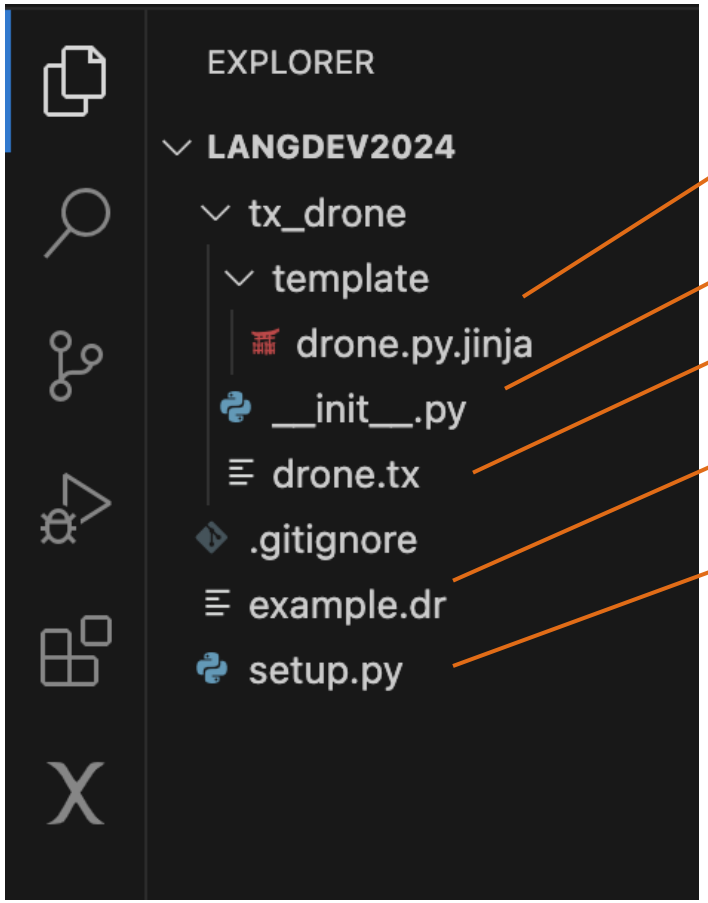
- Grammar and Program instant validation (error reporting)
- Syntax highlighting

```
tx_drone > drone.tx
1   Program:
2     'begin'
3       commands*=Command
4     'end'
5   ;
6
7   Command:
8     RotateCommand | FlipCommand | MoveCommand
9   ;
10
11  RotateCommand:
12    'rotate' deg=INT
13    Expected '=' or '*=' or '+=' or '?=' or '*' or '?' or '+' or '#' or '-' or
14
15    View Problem (⌘.)    No quick fixes available
16  FlipCommand:
17    'flip' direction=FlipDirection
18  ;
```

```
example.dr
1   begin
2     Expected 'rotate' or 'flip' or 'move' or 'end'
3
4     View Problem (⌘.)    No quick fixes available
5       mov
6       fli  abc move
7   end
```

Drone Example Demo

Drone Example



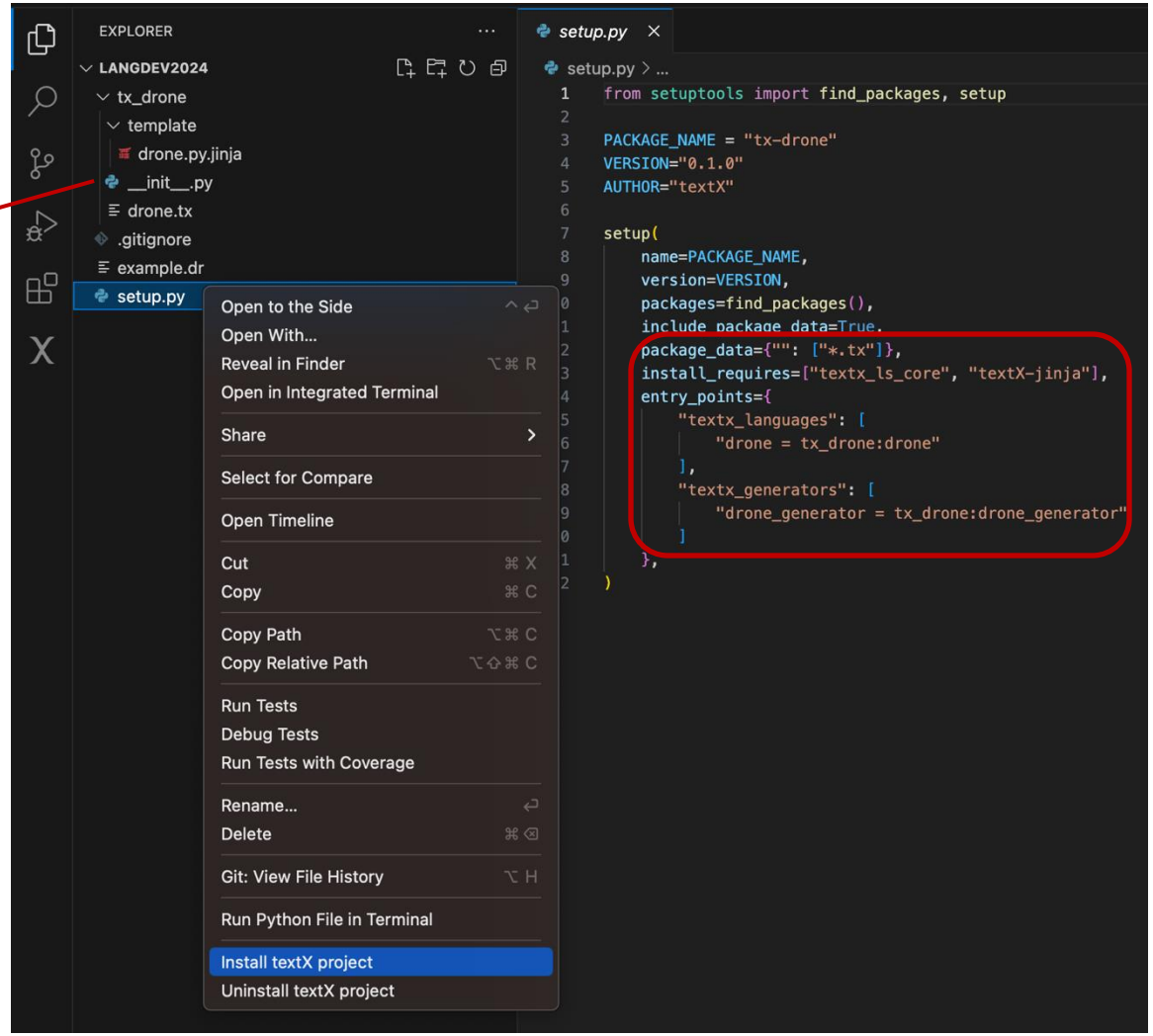
- Template
- Language and generator registration
- Grammar
- Program
- Project config file

GitHub: https://github.com/textX/langdev2024

Drone Example

- Language and generator registration

```python
from os.path import dirname, join

from textx import generator, language, metamodel_from_file
from textxjinja import textx_jinja_generator


@language("Drone", ".dr")
def drone():
    "A language for giving flight commands to drone"
    return metamodel_from_file(join(dirname(__file__), "drone.tx"))


@generator('Drone', 'python')
def drone_generator(metamodel, model, output_path, overwrite, debug):
    "Generate executable python script from Drone model"

    current_dir = dirname(__file__)
    templates_path = join(current_dir, 'template')
    default_output_path = join(current_dir, '..', 'dist')

    context = {
        'commands': model.commands
    }

    textx_jinja_generator(templates_path, output_path or default_output_path, context, overwrite)
```

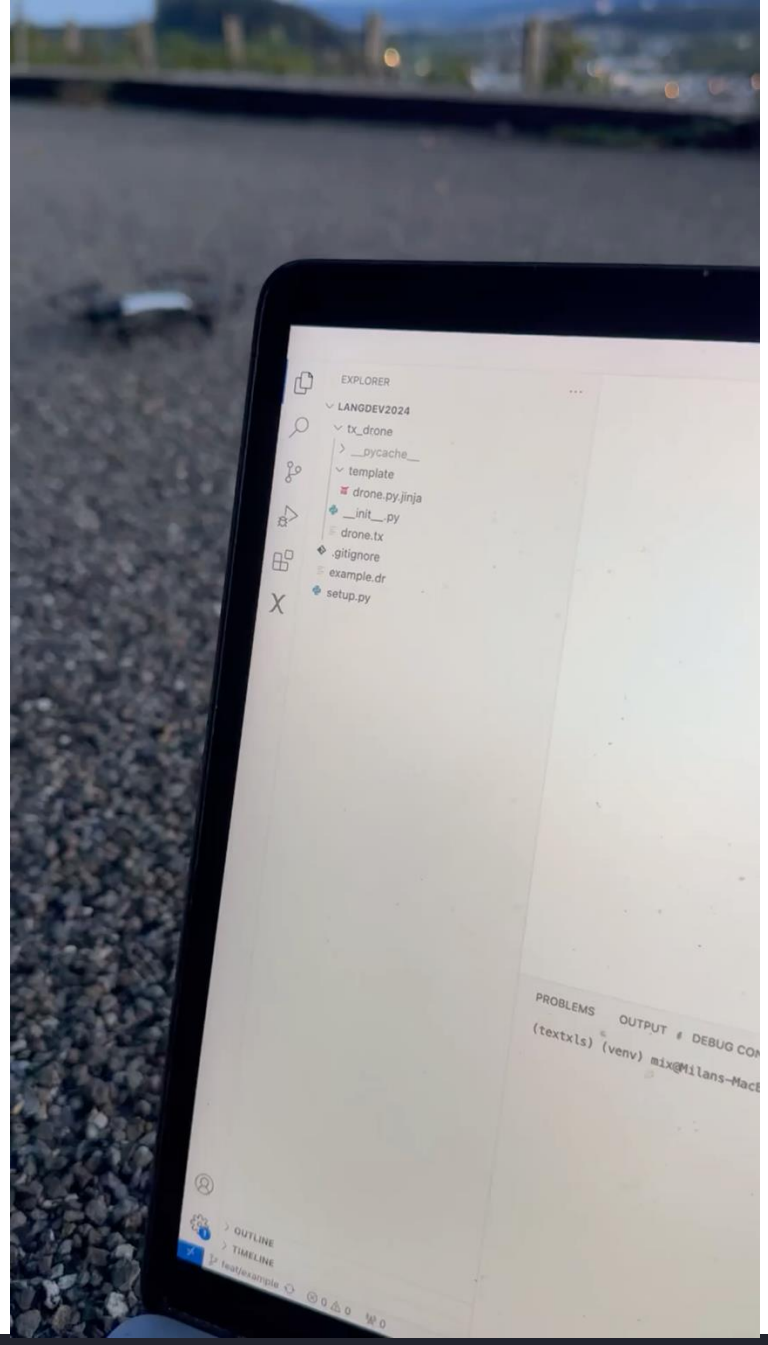


Drone Example

- Generated code execution

```
begin
    move left 50
    rotate 90
    move forward 50
    move up 20
end
```

```
from djitellopy import tello

drone = tello.Tello()

drone.connect()
drone.takeoff()

drone.move_left(50)
drone.rotate_clockwise(90)
drone.move_forward(50)
drone.move_up(20)

drone.land()
```



Summary

Latest Updates and Next Steps

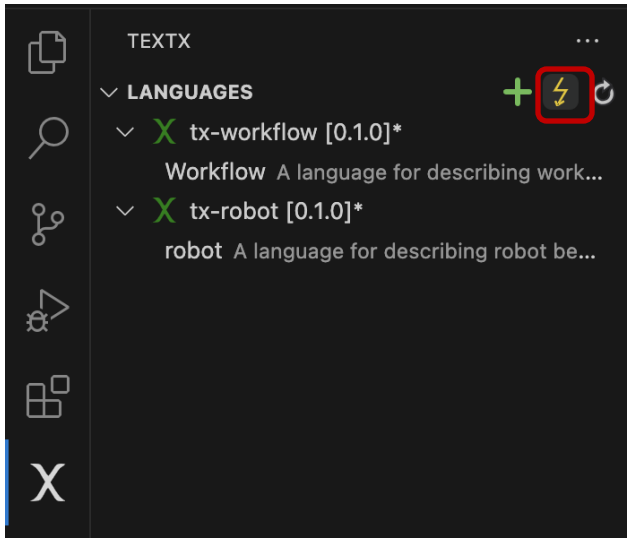
Summary – textX Repositories

- textX – language
- textX-LS (upgraded) – language server and VC Code extension
- textx-playground (new) – web playground
- textX-jinja – template-based code generation from textX models
- textX-dev – project scaffolding
- textX-lang-questionnaire – questionnaire DSL, used by textX-dev

Summary – Latest Updates

- Created textX Web Playground
- textX LS:
  - upgraded python, textX and other dependencies versions
  - packages textx-ls-core 0.2.0 and textx-ls-server 0.2.0
- VS Code Extension upgraded – textX v0.2.0

Summary – Next Steps



- VS Code Extension improvements:
  - project scaffolding, using textX-dev
  - run code generators from tree view
  - run textX LS in VS Code inside Pyodide (no Python dependency)

- Playground improvements:
  - use textX LS instead of Pygls directly

JGBX

ProxyHands

Q&A

textX Organization | https://github.com/textX

Presentation and Demos | https://github.com/textX/langdev2024