Powerful Pythonic Patterns

http://www.aleax.it/pycon_ppp.pdf

Audience levels for this talk

10' Q & A at the end

(+: let's chat later!)

What's a Pattern?

- identify a closely related class of problems
  - if you have no problem, why solve it?-)
- identify a class of solutions to the problems
  - closely related, just like the problems are
- may exist in any one of many different possible scales

A Pattern's "problem"

- each Pattern addresses a problem
  - really, a closely related class of problems
- a problem is defined by:
  - "forces"
    - constraints, desiderata, side effects
  - "context" (including, what technologies can be deployed to solve the problem)

A Pattern's "solution"

- to describe a pattern, you must identify a class of solutions to the problems
  - meaningful name and summary
  - a "middling-abstraction" description
  - real-world examples (if any!-), "rating"
    - one-star == "0/1 existing examples"
  - rationale, "quality without a name"
  - how it balances forces / +'s & issues
  - pointers to related/alternative patterns

Is any field Pattern-less?

- if a field of endeavor is bereft of patterns,
  - either they haven't been looked for yet,
  - or else that alleged "field" is merely a bunch of perfectly chaotic, ergodic processes (in fact, not a "field" at all!-)

Why bother w/Patterns?

- identifying patterns helps all practitioners of a field "up their game" towards the practices of the very best ones in the field
  - precious in teaching, training, self-study
  - precious in concise communication, esp. in multi-disciplinary cooperating groups

What's a DESIGN Pattern?

- we work in order to deliver value to people
- our work is a connected mesh of activities that fall in distinguishable, different areas
- design is one of these many areas of activity into which we can classify our work

Why do we work, at all?

- we work in order to deliver value to people
  - "make them feel more alive"
  - AKA "the Quality without a name"

How do we work effectively?

- our work is a connected mesh of activities
  - find problems, opportunities, connections
  - identify system structure, details, forces
  - invent (or discover!) possible solutions
  - experiment (prototype) to evaluate them
  - develop (apply) solid implementations
  - test, deploy (deliver, distribute), document
- as for every taxonomy, lines are a bit blurred and even somewhat arbitrary...
  - ...but it can still help organize ourselves!-)

"Design" is a vague term...

- most generically, it can mean "purpose"
- or specifically, a plan towards a purpose
- a geometrical or graphical arrangement
- an "arrangement" in a more abstract sense
  - ...
- in saying "Design Patterns", we mean "design" in the sense common to buildings architecture and software development:
  - work phase between study/analysis and "actual building" (not _temporally_;-)
- (SWers use "architecture" differently;-)

What other kinds are there?

- Analysis: find/identify value-opportunities
- Architecture: large-scale overall-system approaches to let subsystems cooperate
- Human Experience: focus on how a system presents itself and interacts with people
- Testing: how best to verify system quality
- Cooperation: how to help people work together productively to deliver value
- Delivery/Deployment: how to put the system in place (& adjust it iteratively)
- ...

What's a "Pythonic" pattern?

- a Design pattern arising in a context where (part of) the technology in use is Python
- well-adapted to Python's strengths, if and when those strength are useful
- dealing with Python-specific issues, if any
- see e.g: http://www.aleax.it/goo_pydp.pdf

Pythonic Template Method

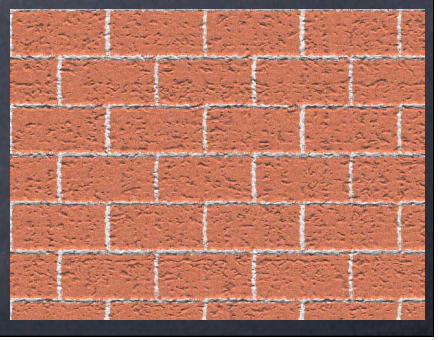
- template == "self-delegation"
  - classically, via inheritance: base class has organizing-method, subclasses do hooks
- specifically-Pythonic aspects:
  - overriding data (Queue, ...)
  - ABCs (or mixins) w/organizing-methods
  - "factored-out" hooks (via delegation)
  - organizing class can use runtime introspection to find hook-methods
  - all of the above (unittest.TestCase)

Dependency Injection as TM

- a form of "factored-out" TM (_and_ a form of "Hollywood Principle" aka "Callback" DP)
- "inject" the hooks (callables) as arguments (or settable attributes of organizing class)
  - works well with Factory, when the hooks' job is to build/return usable objects
- works best with first-class callables
  - in Python: functions, classes, bound methods, closures, callable instances, ...
  - ...wide variety → high applicability!

BTW, what's an "Idiom"?

- small-scale, technology-specific, common choice of name, arrangement, or procedure
- e.g.: "brick-overlap wall" (brick-specific)
  - pre-stressed concrete, wood, &c have somewhat-related but different idioms
- `if __name__ == '__main__': ...`
  - only makes sense in Python
- `while(*dest++ = *source++) {}`
  - only makes sense in C (or C++)
- for(x=y.begin(); x!=y.end(); ++x)...



ANTI-Patterns (& Idioms)

- commonly-occurring, but counterproductive
- Waterfall, Analysis Paralysis, Moral Hazard, Groupthink, Abstraction Inversion, FatBase, Copy&Paste, BackupGenerator, Polling, ...
- Some Python-specific examples...:

```
def __init__(self, this, that):  # useless override
  super(Cls, self).__init__(this, that)

for string_piece in many_pieces: # += loop on str
  big_string += string_piece

sum(list_of_lists, [])           # same (!) on list
```

+, any use of `reduce`!-)

Pattern *Languages*

- think of each pattern as a word
- how are they combined in "discourse"?
  - "grammar", semantics, pragmatics
- hierarchical relationship among patterns of different scales / levels of abstractions
- "peer" relationship among "sibling" patterns

Hierarchical relationships

- different scales compose/decompose "into each other" (smaller-scale patterns often emerge in the context of larger-scale ones)
  - PlugIn architecture pattern is helped by design patterns Template, Factory, DI, ...
  - simple Factory or Facade cases can use `import/as` idiom:

```
if ...: import posix as os
else: import nt as os
# then use os.this, os.that freely
```

"Peer" pattern cooperation

- patterns at the same scale work together
  - methodology-patterns CodeReviews, FanaticalTests, ContinuousBuild cooperate
  - Dependency Injection uses Callback to implement a variant of Template Method
    - and often uses Factory patterns too
  - Strategy and Memento used together let a Skeleton class delegate _both_ behavior _and_ state issues (!)

Q & A

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