So you think your startup is worth $10 million...

EuroPython 2016
Bilbao, Basque Country, Spain
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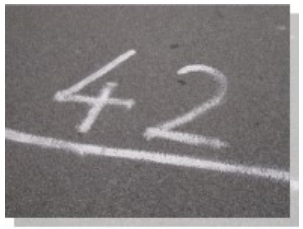
Speaker Introduction

Marc-André Lemburg

- Python since 1994
- Studied Mathematics
- eGenix.com GmbH
- Senior Software Architect
- Consultant / Trainer
- Python Core Developer
- EuroPython Society
- Python Software Foundation
- Based in Düsseldorf, Germany





Agenda

- Introduction
- Analysis
- Models
- Valuation
- Make of buy
- Conclusion

Buying Python Startups

Disclaimer

- These ideas were used in an actual valuation
  - We do not claim completeness
  - We do not claim scientific accuracy

- The results do make sense based on our experience in running projects

Value of an IT startup

- Business value
  - Market share = users / market size
  - Cost efficiency (HR, processes)
  - Innovation factors
  - Risks (affecting operations)
  - ...
- IT value
  - Quality of developers / managers
  - Application design quality (structure, flexibility)
  - Code quality (structure, metrics, tests)
  - Risks (affecting technical capabilities)
  - ...

Risks

Business risks

- Affecting the business operation
  - Loosing important employees
  - Financial / investment risks
  - Market changes
  - Competing against open source / freebies
  - Infringements (patent/trademark/regulations)
  - Downtime
  - Data security breaches
  - ...

IT risks

- Affecting technical capabilities
  - Problems in third party tools / extensions /services (dependencies)
  - Scalability problems (increase in load or storage requirements)
  - Flexibility problems (slow innovation)
  - Maintenance problems (fixing bugs takes too long)
  - Hardware issues (failing servers, disks, connectivity)
  - Environmental issues (fire, earthquake, storm)
  - ...

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IT valuation project approach

- Analyze IT approach, team, system and data
- Initial development valuation based on:
  - COCOMO model
  - Effort model
- Apply “Added Value” factors (including risk)
- Compare with reimplementation estimate

  → Make or buy

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IT valuation analysis factors

- Soft factors
  - Quality of developers
  - Architecture quality
  - Data model quality
  - Algorithmic quality
  - Extensibility
  - Risks
- Factors (partially) based on metrics
  - Code quality
- Known inaccuracies
  - Estimation risk buffer

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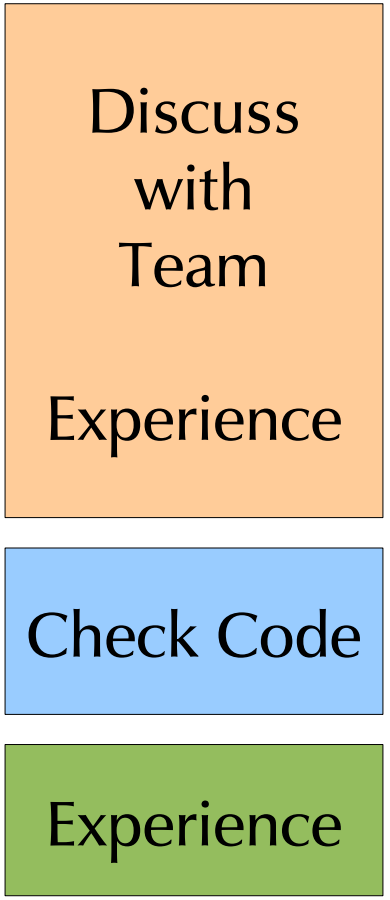

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Check Code

Raw code metrics

- Source data analysis
  - Lines of code (LOC), Source lines (SLOC), Logical lines (LLOC)
  - Blank lines = better readability
  - LOC per module
  - Functions/methods/classes per module

    → Affect maintainability
- Python tool: Radon
  - https://pypi.python.org/pypi/radon

Raw code metrics

- Inline documentation
  - Comment lines (in relations to LOC)
  - Doc strings (in relation to LOC)

    → Affect readability and maintainability

- Python tool: Radon
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Code metrics

- Cyclomatic Complexity (CC)
  - more decision nodes = higher complexity
  - higher values = worse
- Maintainability Index (MI)
  - combination of complexity, density, SLOCs and comment lines
  - higher values = better
- Python tool: Radon
  - https://pypi.python.org/pypi/radon

Test coverage

- Check unit test code coverage of code base
  - should show high values
  - note: 100% coverage is often misleading
- Check for end-to-end tests
  - should provide good coverage as well
- Check for randomized tests
  - to avoid biased test cases / missing test cases
- Python tool: coverage.py
  - https://coverage.readthedocs.io/

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Intermediate COCOMO Model

- COCOMO model is an industry standard for code valuation based on LOC
  - C/C++
  - Java
- Models:
  - Organic projects - small teams, senior/regular people, agile process
  - Semi-detached projects – medium sized teams, mixed skill set, semi-rigid requirements
  - Embedded projects – tight requirements, low level architectures, usually hardware based

Intermediate COCOMO Model

- Formulas:
  - Effort Applied $E = a * kLOC^{b} * EAF$ (in person months)
  - Dev Time $D = c * E^{d}$ (in months)
  - People required $P = E / D$ (in persons)
- Parameter selection (organic project category):
  - a=2.40, b=1.05, c=2.50, d=0.38
- Adjustment factor EAF (lower = more efficient)
  - Normal: 0.9 – 1.4 (Java, C)
  - Python: 0.5

https://en.wikipedia.org/wiki/COCOMO

Intermediate COCOMO Model Value

- Value = Developer costs * Development time
  - Take into account different costs for senior and regular developers
  - Use market rates / apply startup discounts
  - Add employer labor costs

Effort model

- Time it took the company to build its system
  - Broken down by senior and regular developers used in the process

- Value = Developer costs * Development time
  - Take into account different costs for senior and regular developers
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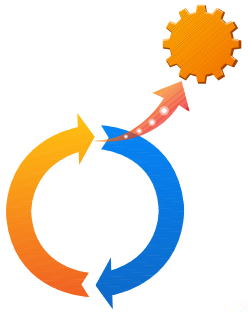

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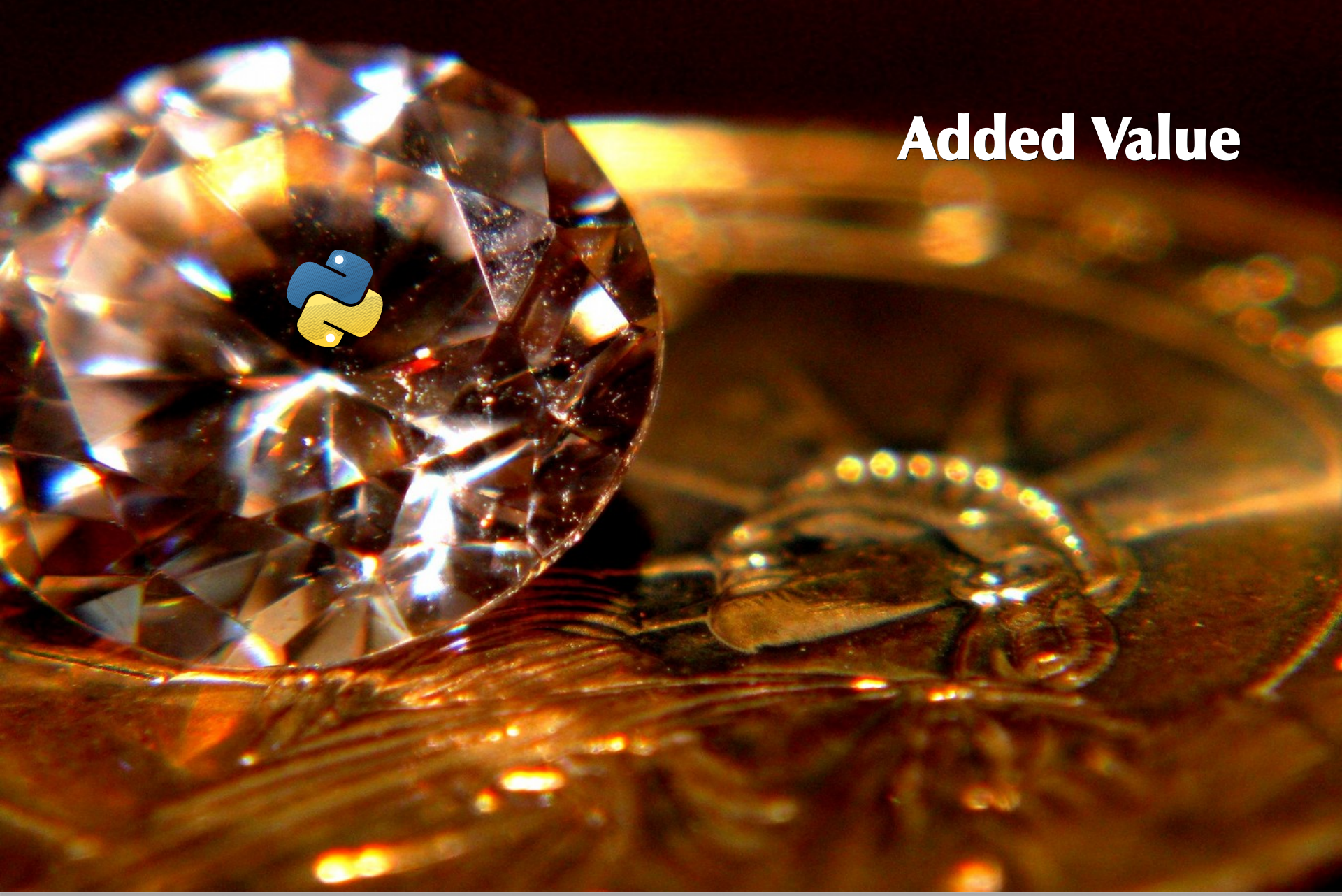
Added Value



Added value

- Apply +/- Factor % in the following categories:
  - Quality of developers
  - Architecture quality
  - Data model quality
  - Algorithmic quality
  - Code quality
  - Extensibility
  - Risks

  - Estimation risk buffer

Code valuation

- Pragmatic approach:
  Average from applied models
  - COCOMO model
  - Effort model
- Apply added value factor
- Final estimate

Data valuation (if applicable)

- Average from applied models
  - ~~COCOMO model~~
  - Effort model
- Apply added value factor
- Final estimate

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Make or buy

- Costs of replicating the company,

  including

  - products / data
  - expertise
  - reaching market share

Make or buy

- Business side
  - Setting up company
  - Recruiting
  - Marketing costs
  - ...
- IT systems
  - Costs of acquiring needed expert knowledge
  - Costs of reimplementing all systems
  - (Costs of recreating data)
  - Development time

Make or buy

- Business side
  - Setting up company
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  - (Costs of recreating data)
  - Development time

Make or buy

- For IT systems:
  - use existing system as specification
  - estimate effort needed to recreate systems
  - (estimate effort needed to recreate data)
  - since timing is important:
    use senior developers only

- Result: Offer for rebuilding the system

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Add Value to your Startup

How to increase the IT value of a Python startup

- Pay attention to code complexity / structure/ quality
- Design in a flexible and easily extensible way
- Pay attention to code test coverage and documentation
- Invest into good data(base) structures
- Invest into good algorithms
- Reduce risks added via 3rd party dependencies

Questions

Photo References

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Thank you for your attention

Beautiful is better than ugly.

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