

A Probabilistic Approach to Service Selection with Conditional Contracts and Usage Patterns

Adrian Klein, Fuyuki Ishikawa, and Bernhard Bauer
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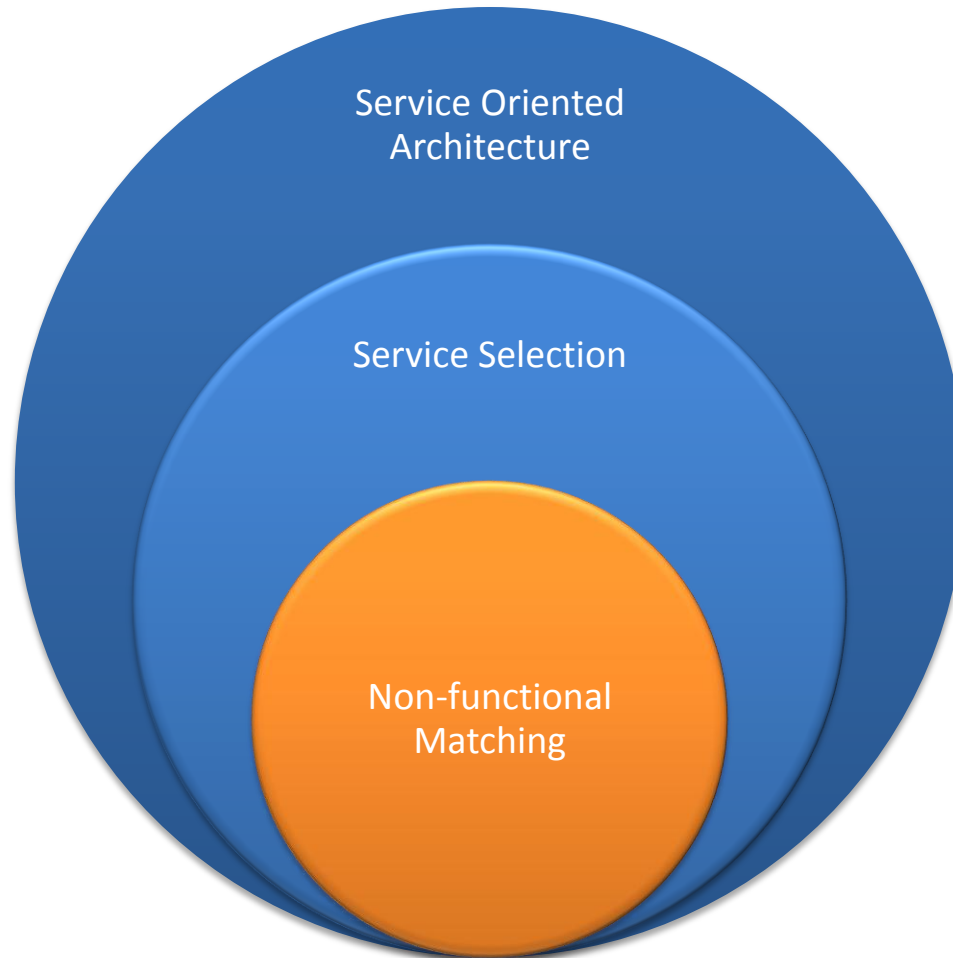
Agenda

1. Introduction
2. Scenario
3. Approach
4. Related Work
5. Evaluation
6. Conclusion

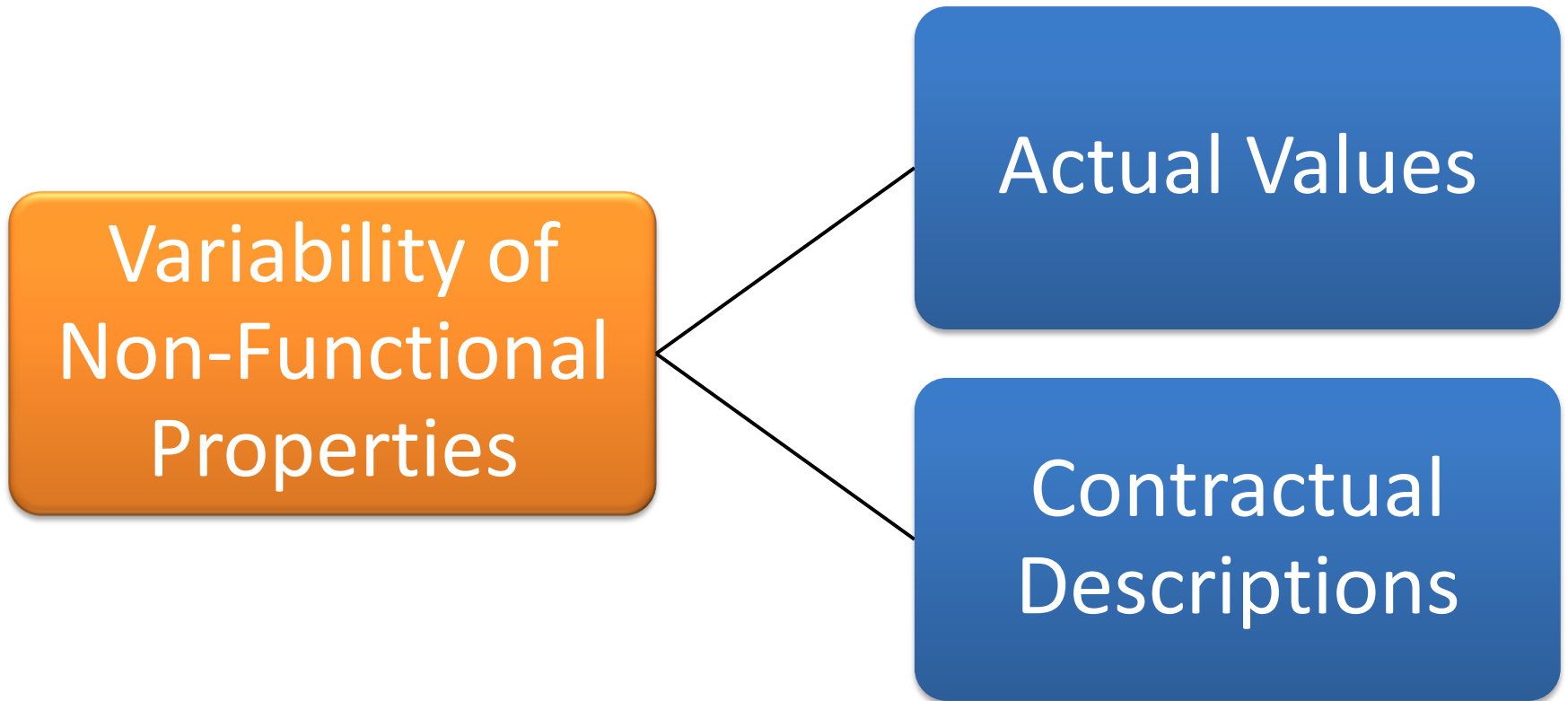
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Research area



Focus



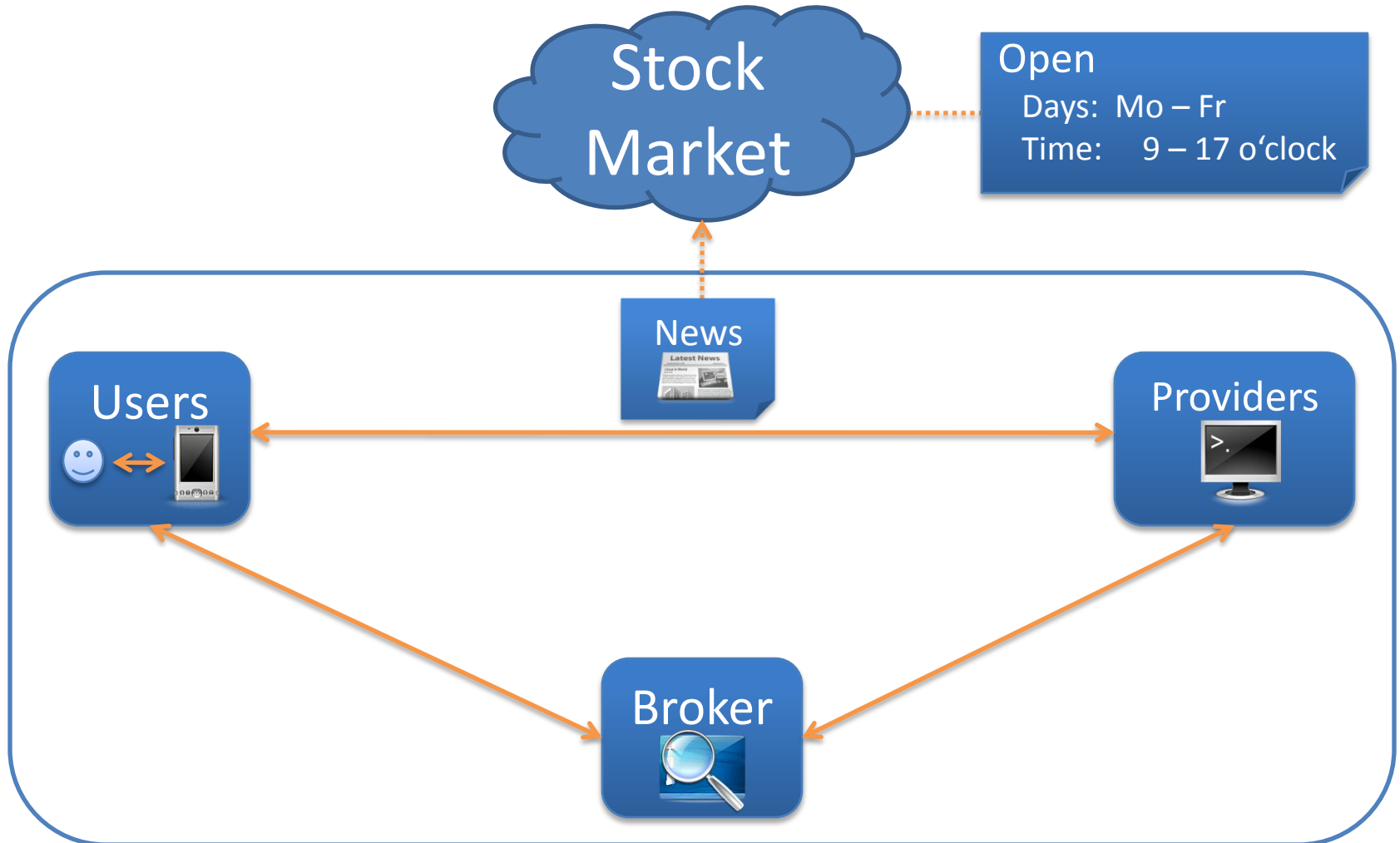
Idea

```
contract {  
  response time = 1 ns  
  price = $  
}
```

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Scenario



Challenges

Users

Providers

Needs	Business	Casual
Response time	high	medium
Price	low	High

+

Time of Usage	Business	Casual
Mo-Fr, 9-17	mainly	rarely
Mo-Fr, else	sometimes	sometimes
Sa-Su	rarely	mainly



Same **maximum** response time



+

Conditional Pricing

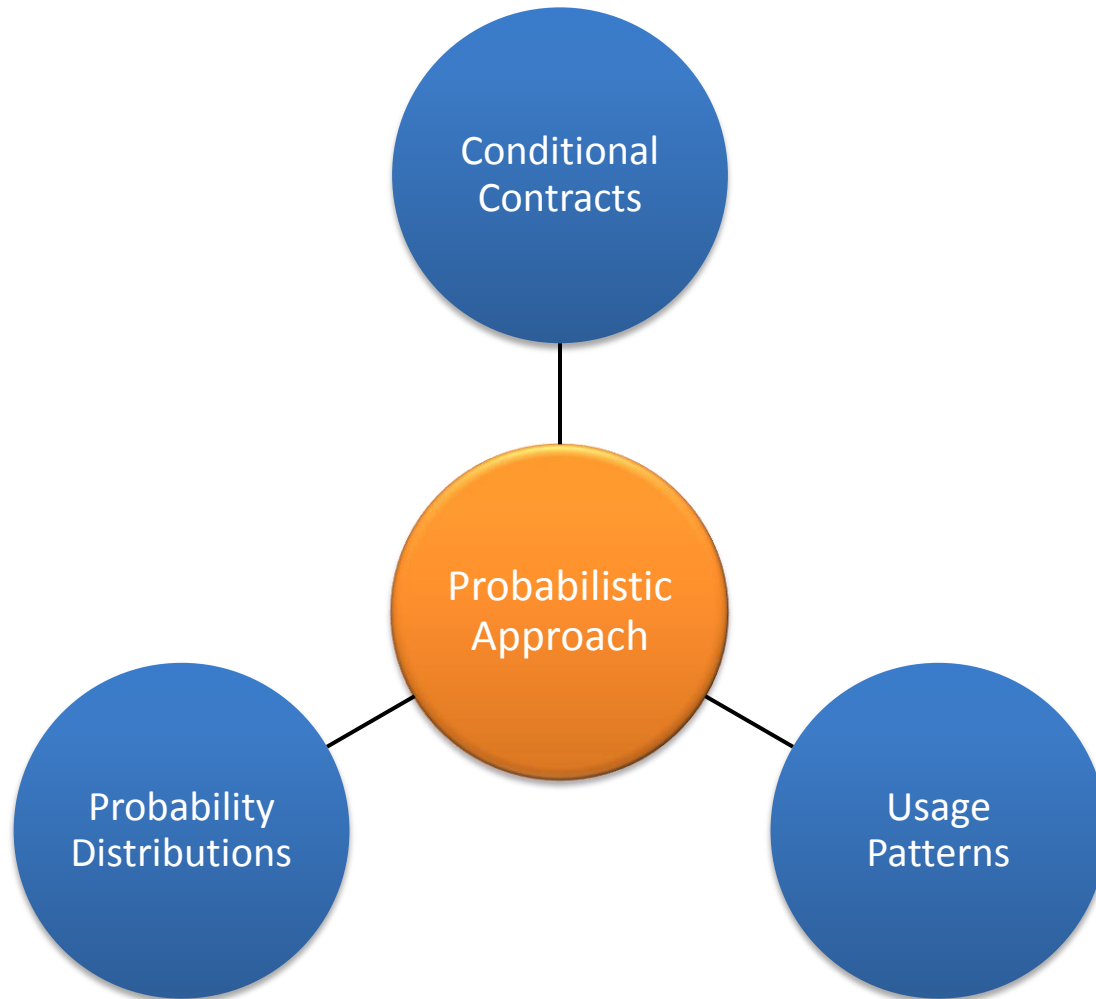
5\$ from Mo-Fr 1\$ from Sa-Su	1\$ from Mo-Fr 5\$ from Sa-Su
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Approach



Conditional Contracts

- Definition

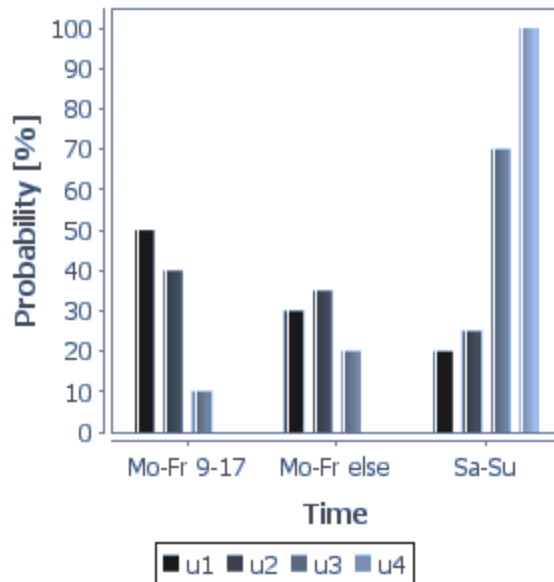
- `<contract> ::= <conditional_statement>`
- `<conditional_statement> ::= <statement> OR
(<condition>, <conditional_statement>, <conditional_statement>)`

- Syntax & Semantics

```
contract {  
  if Mo <= time.weekDay <= Fr  
    if 9 <= time.hour <= 17  
      price = 5 $  
    else  
      price = 2 $  
  else  
    price = 1 $  
}
```

Usage Patterns

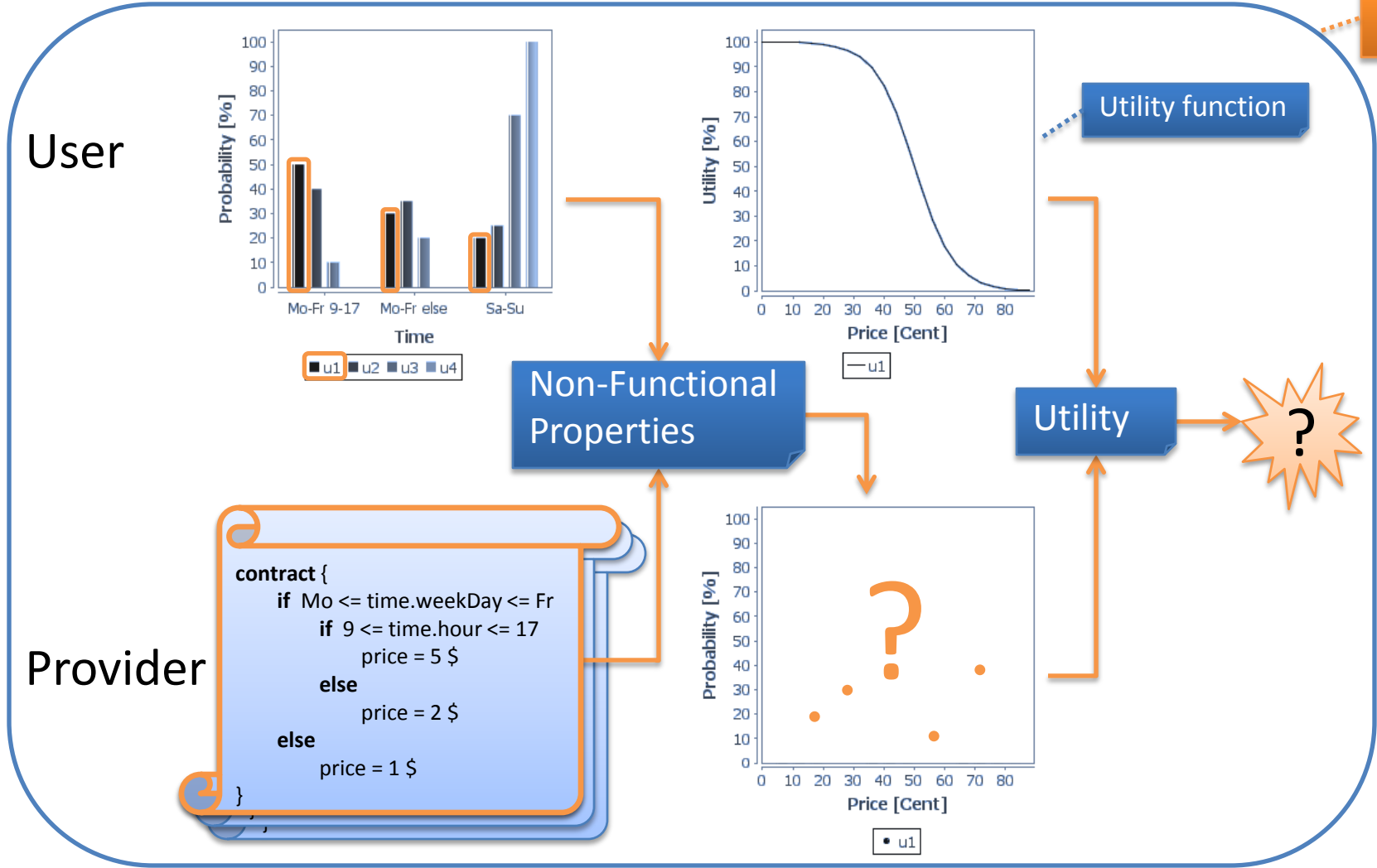
- Definition
 - *A usage pattern tells us in which way a user interacts with a service.*
- Example



Time of Usage
When do the users
call the service?

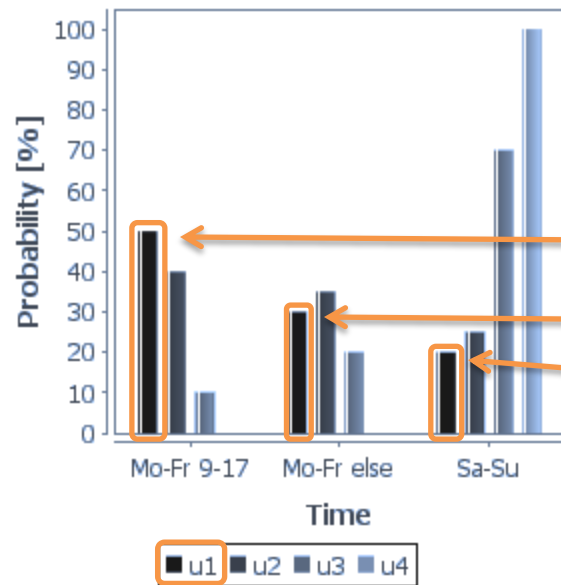
Probabilistic Selection

For each user and contract



Non-Functional Properties

Usage Pattern

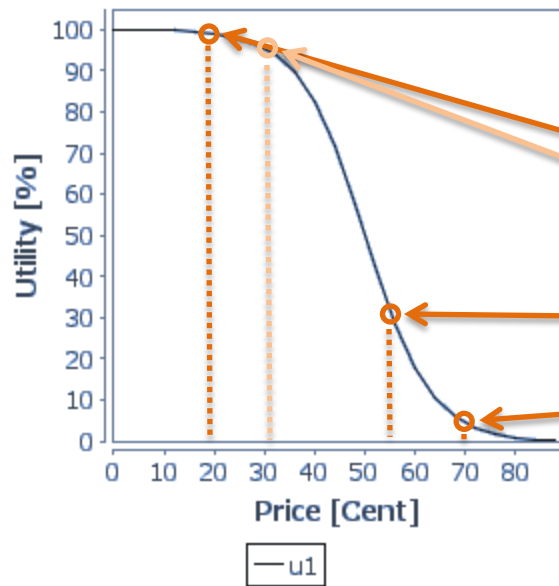


Conditional Contract

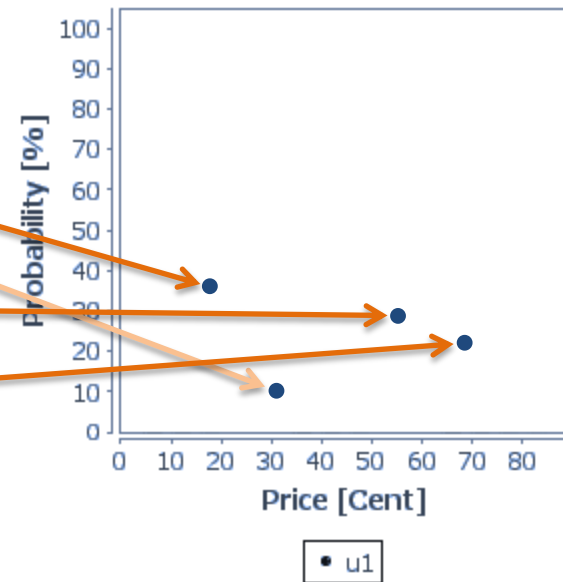
```
contract {  
  if Mo <= time.weekDay <= Fr  
    if 9 <= time.hour <= 17  
      price = 5 $  
    else  
      price = 2 $  
  else  
    price = 1 $  
}
```

Utility

Utility Function



Non-functional Property



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Related Work

1. Probability distributions (Hwang07, Rosario08)

- **for** contract descriptions and service composition
- **not for** service selection

2. Logical rules (Toma07)

- **for** service obligations (\sim contract)
- **not** used for probabilistic computations
- **not** used with usage patterns

3. Usage patterns (Balke03)

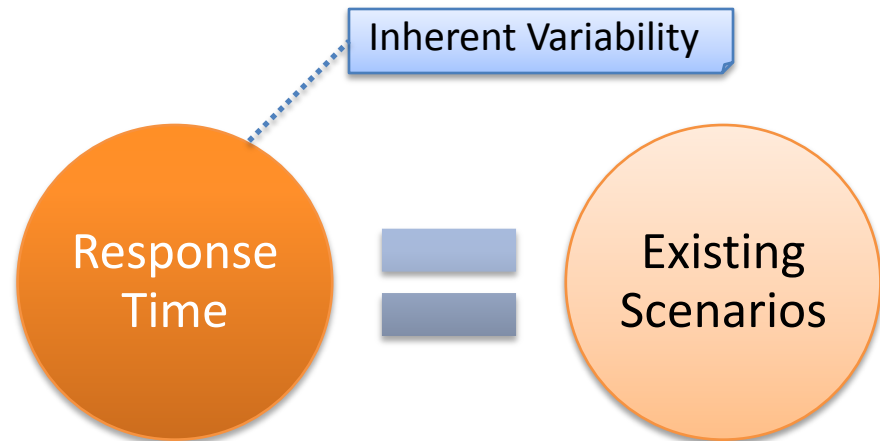
- **only** mentioned
- **not** formally defined
- **not** used for computation

Agenda

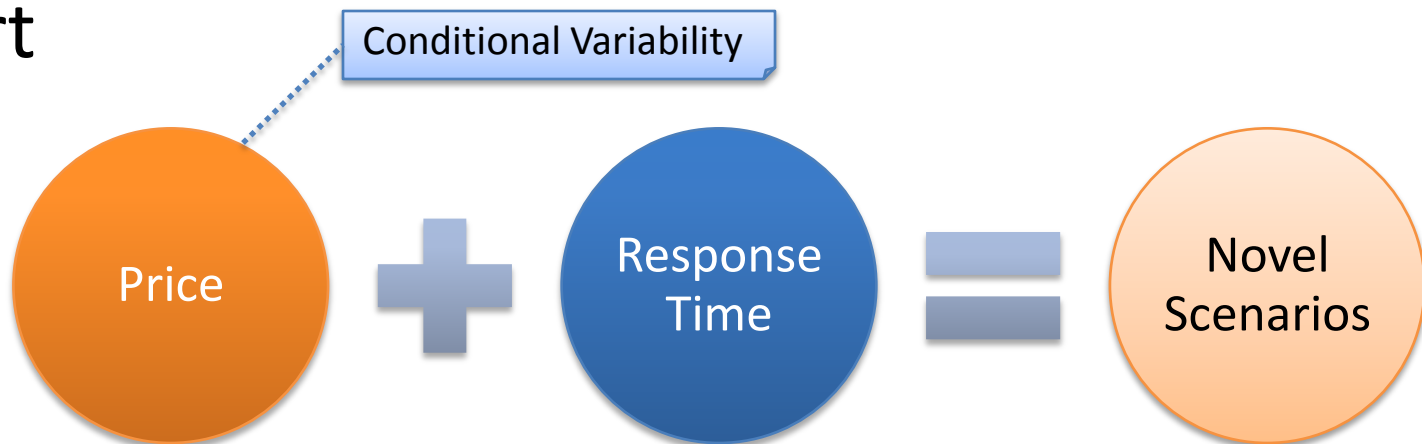
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Parts and Goals

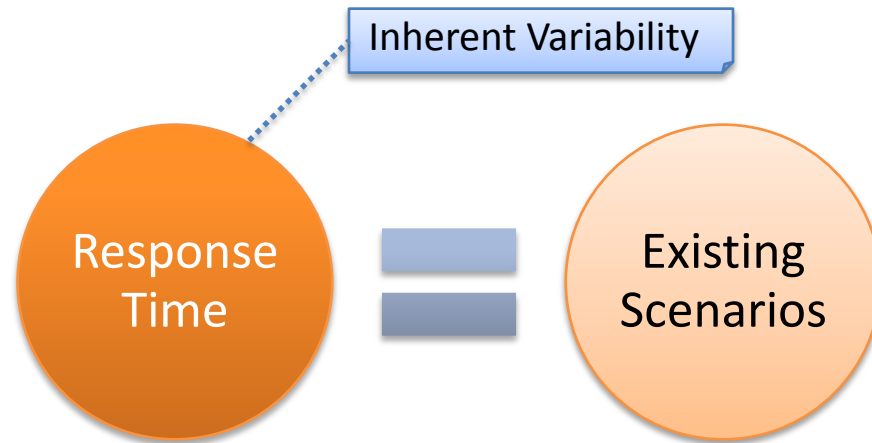
1. Part



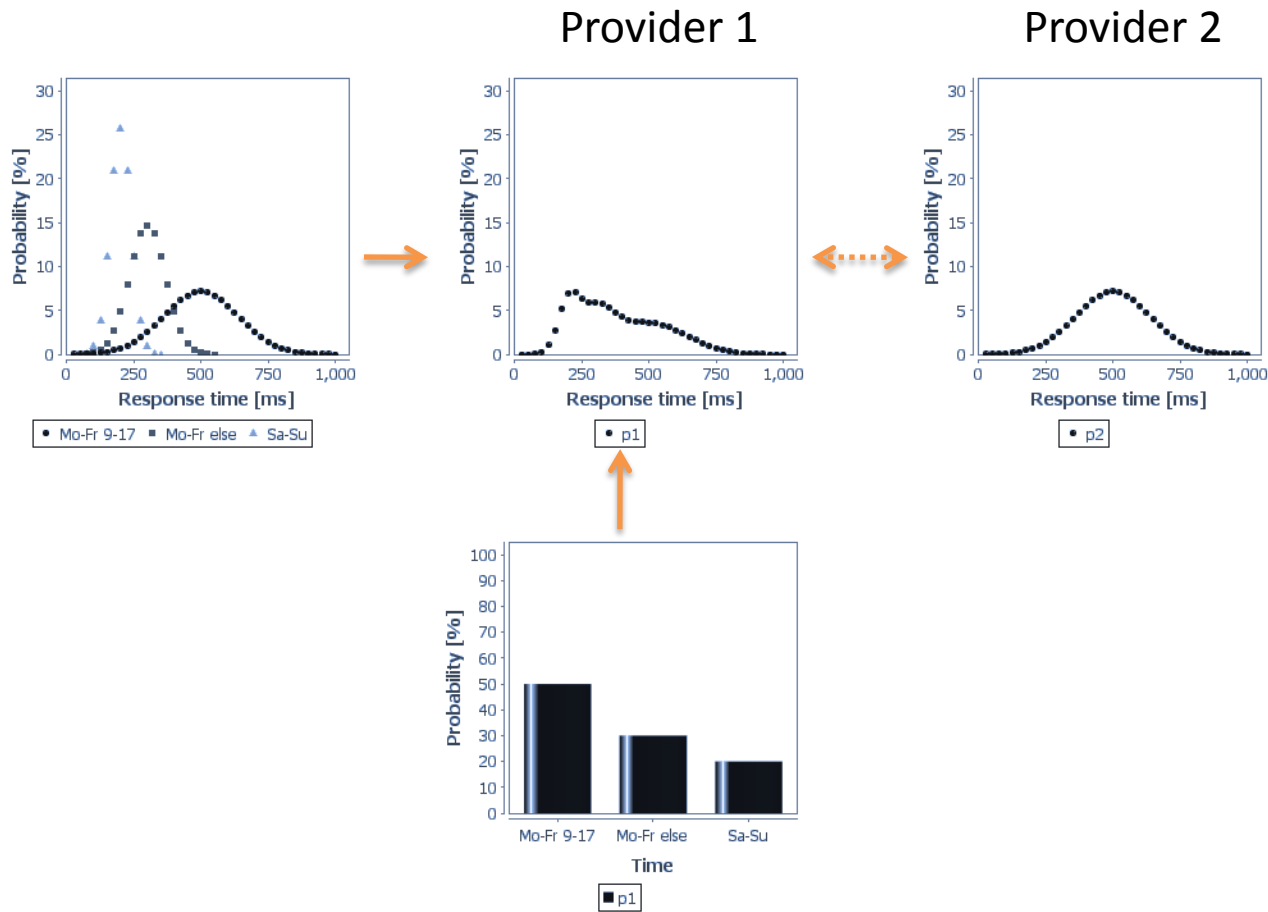
2. Part



1. Part

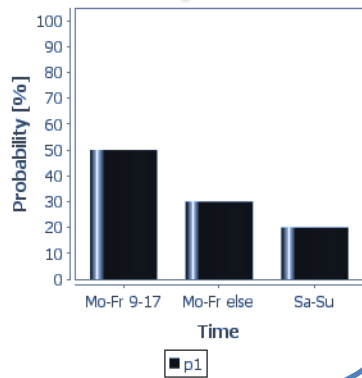
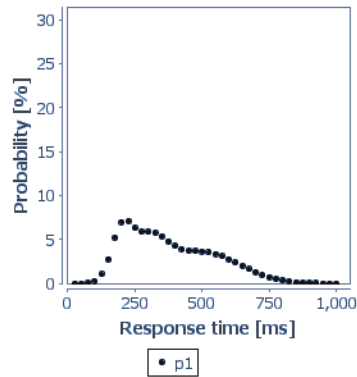
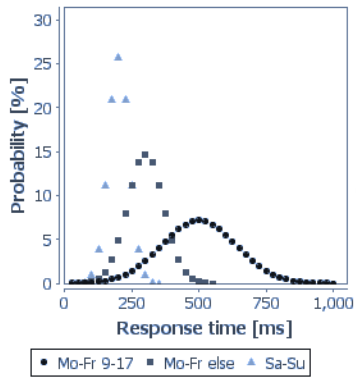


Providers



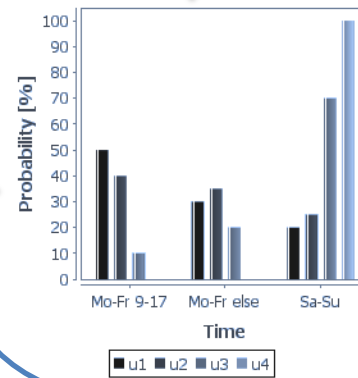
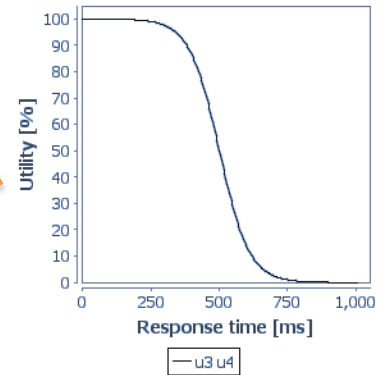
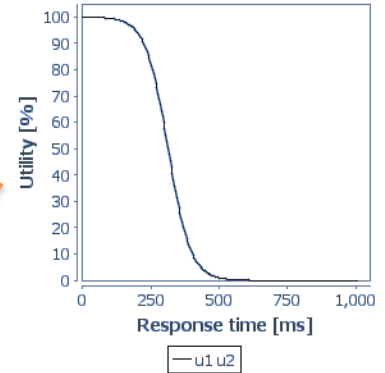
Users

Provider 1



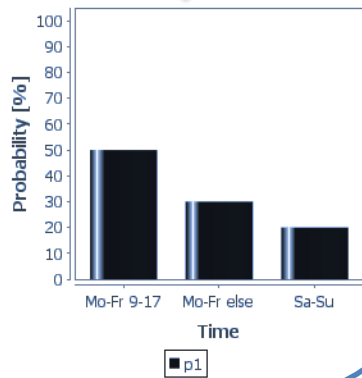
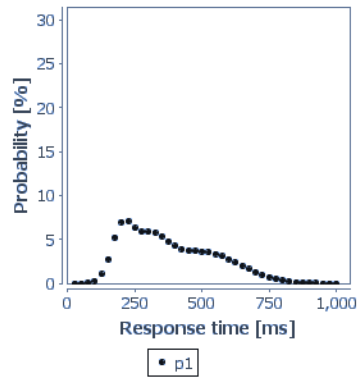
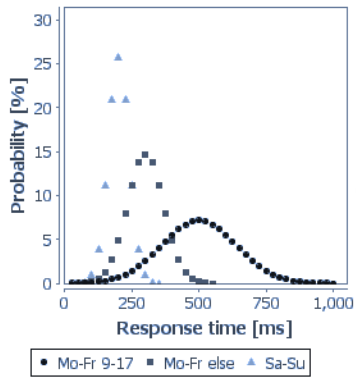
Users

Business
- u1, u2
Casual
- u3, u4

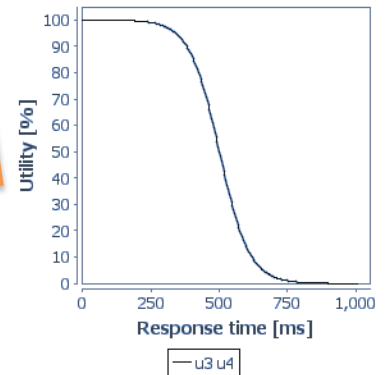
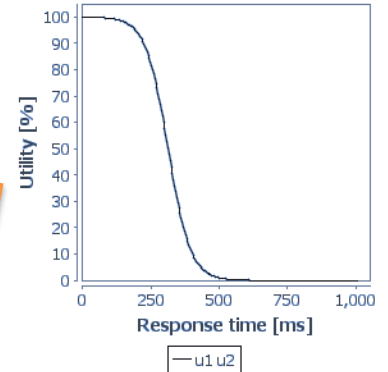
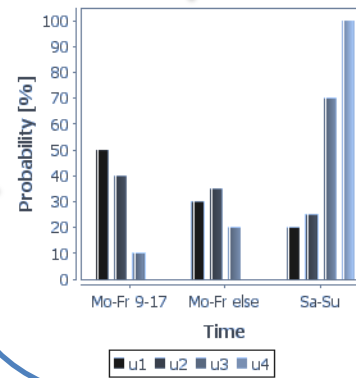
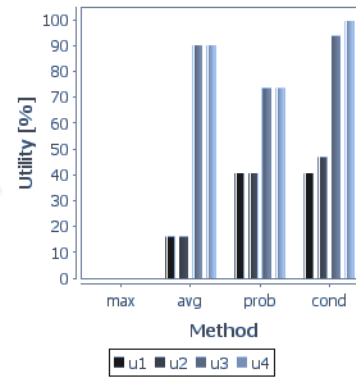


Results (1)

Provider 1

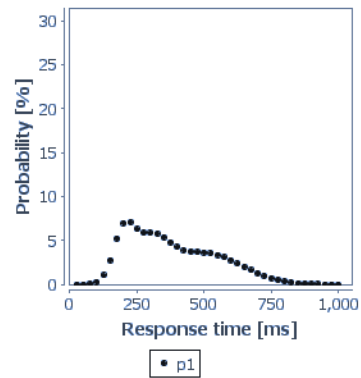


Result

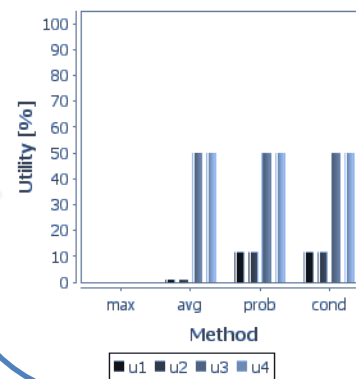
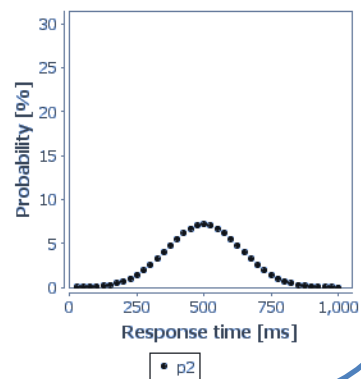
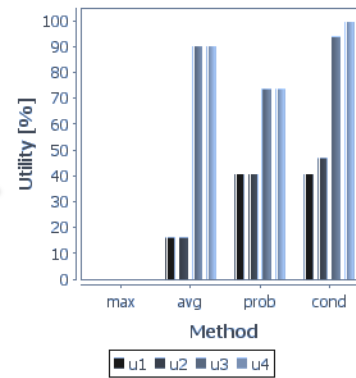


Results (2)

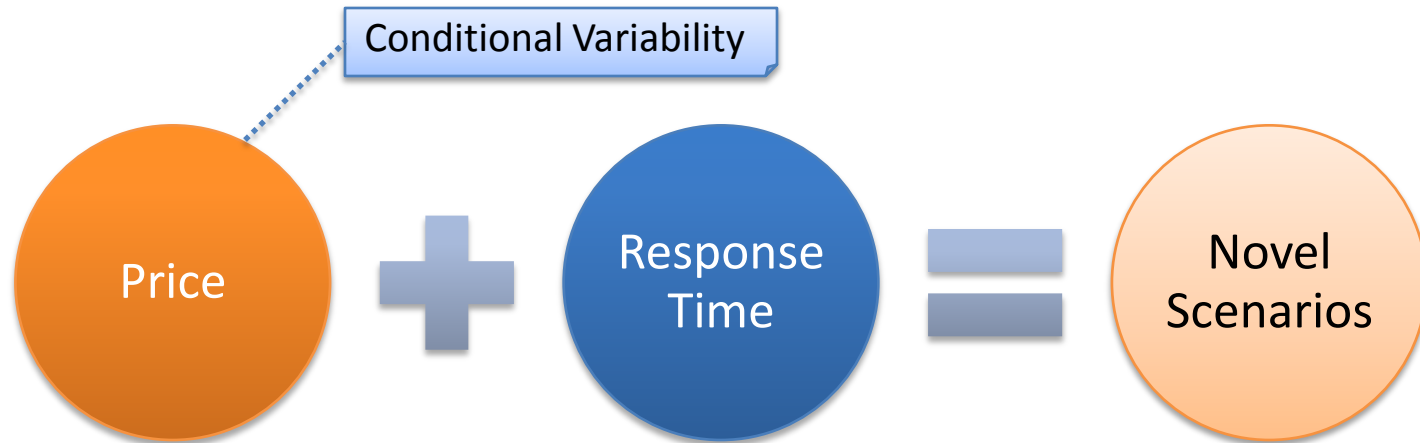
Providers



Results

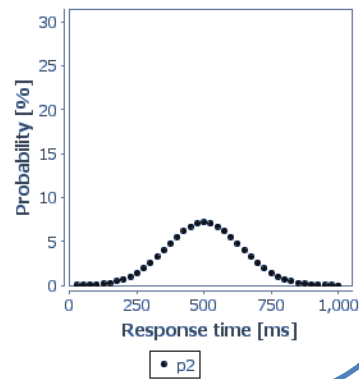
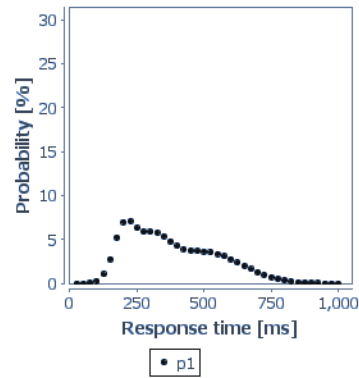
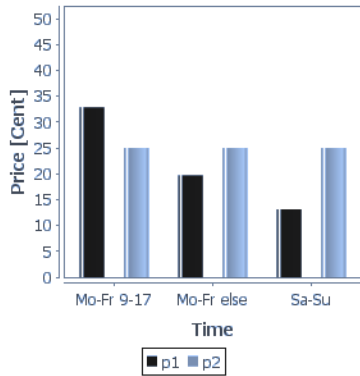


2. Part

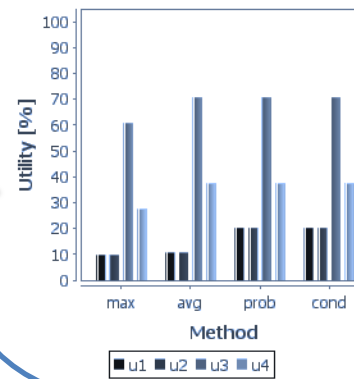
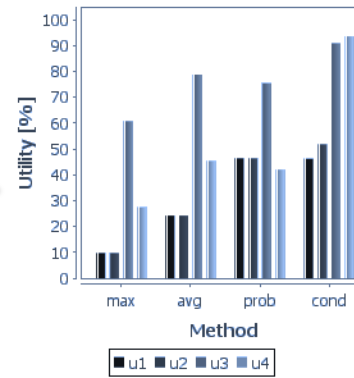


Results

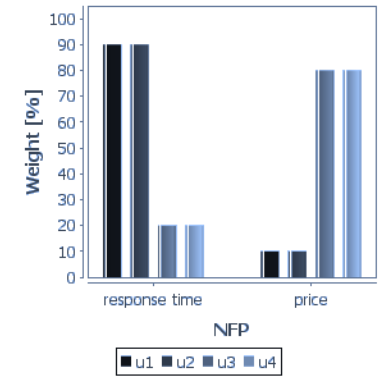
Providers



Results



Utility Functions for Price



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Conclusion

1. Results

- Improvement of selection in existing scenarios
 - ➔ Good for user (better utility)
- Possibility of selection in novel scenarios
 - ➔ Good for provider (differentiation)

2. Future Work

- Realize conditional contracts with SLA standards
 - ➔ With which standards is it possible?
- Apply approach to adaptation
 - ➔ Changes at runtime (usage pattern, conditional contracts)

Thank you for your attention!

References

- Icons
 - <http://www.everaldo.com/crystal/>