An extensible monitoring framework for measuring and evaluating tool performance in a service-oriented architecture

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Outline

- QoS in web services
- Trustworthy software selection
  - Evidence-based decisions for transparency and trust
  - A selection method based on controlled experimentation
- Measuring tool performance
  - Monitoring framework
  - Included tools for performance measurement
  - Properties to measure
- Measuring domain-specific quality aspects
- Selected experiments and discussion

Web Services and QoS

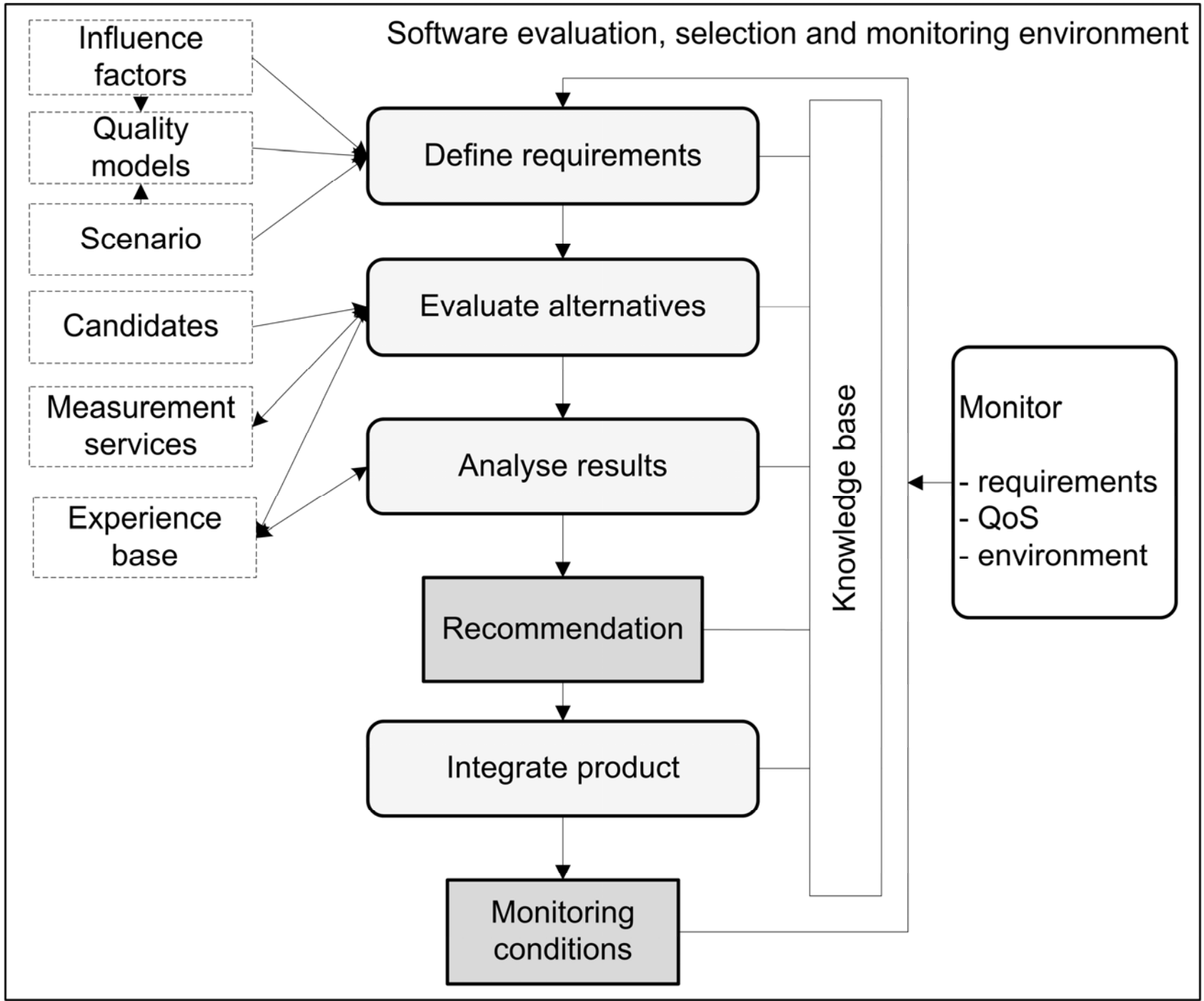
- Late binding and flexible integration ideals
- Service quality and confidence in published metadata often unknown
- Selection and composition
- QoS modelling, ranking, selection
- Client-side measurements

- Round-trip time composed of several factors
- Runtime execution characteristics
- Server-side instrumentation

Trustworthy software selection

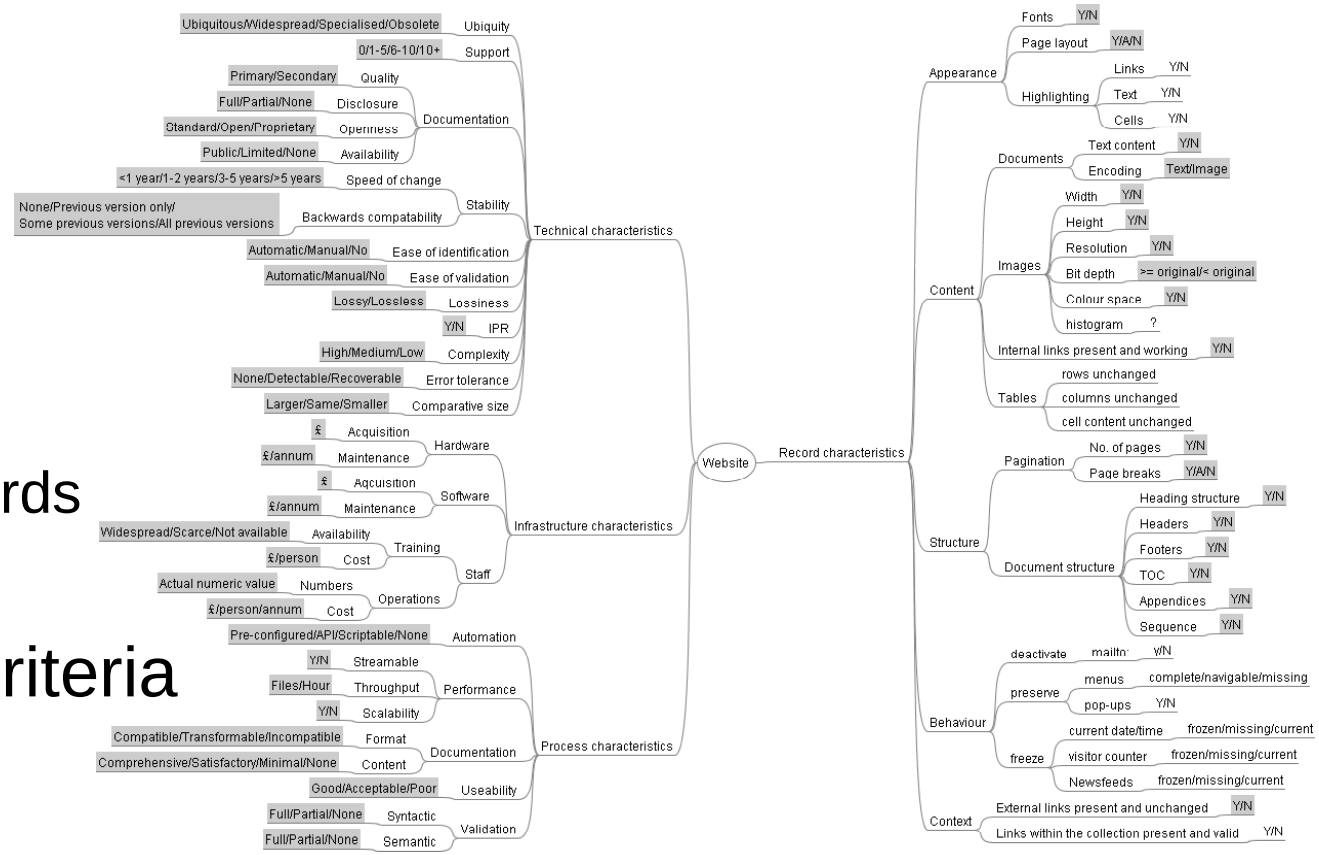
- Commercial-off-the-Shelf (COTS) selection
- COTS evaluation and selection procedures need to consider a wide range of influence factors
- Trustworthy decision making procedures needed
- Need for repeatability, transparency, automation
- Evidence-based evaluation and selection
  - Controlled experimentation
  - Automated measurements
  - Supported by distributed service-oriented environment
  - Candidates accessible as web services
- Digital preservation and preservation planning

Trustworthy software selection



Types of quality criteria

- Static attributes
  - Costs
  - Licensing
  - Documentation
  - Supported standards
  - ...
- Domain-specific criteria
  - Accuracy
  - ...
- Process criteria
  - Performance
  - Memory consumption
  - ...



Trustworthy software selection

- Similar to general web service selection problem, but
  - Service instance used mainly for experimentation
  - After selection, it might even be possible to transfer data to code or vice versa
- Implications for measuring performance
  - Monitoring round-trip time of service consumption is not sufficient
  - Provider-side runtime characteristics are of high interest
  - Client-side monitoring is less valuable
- We need quality-aware services

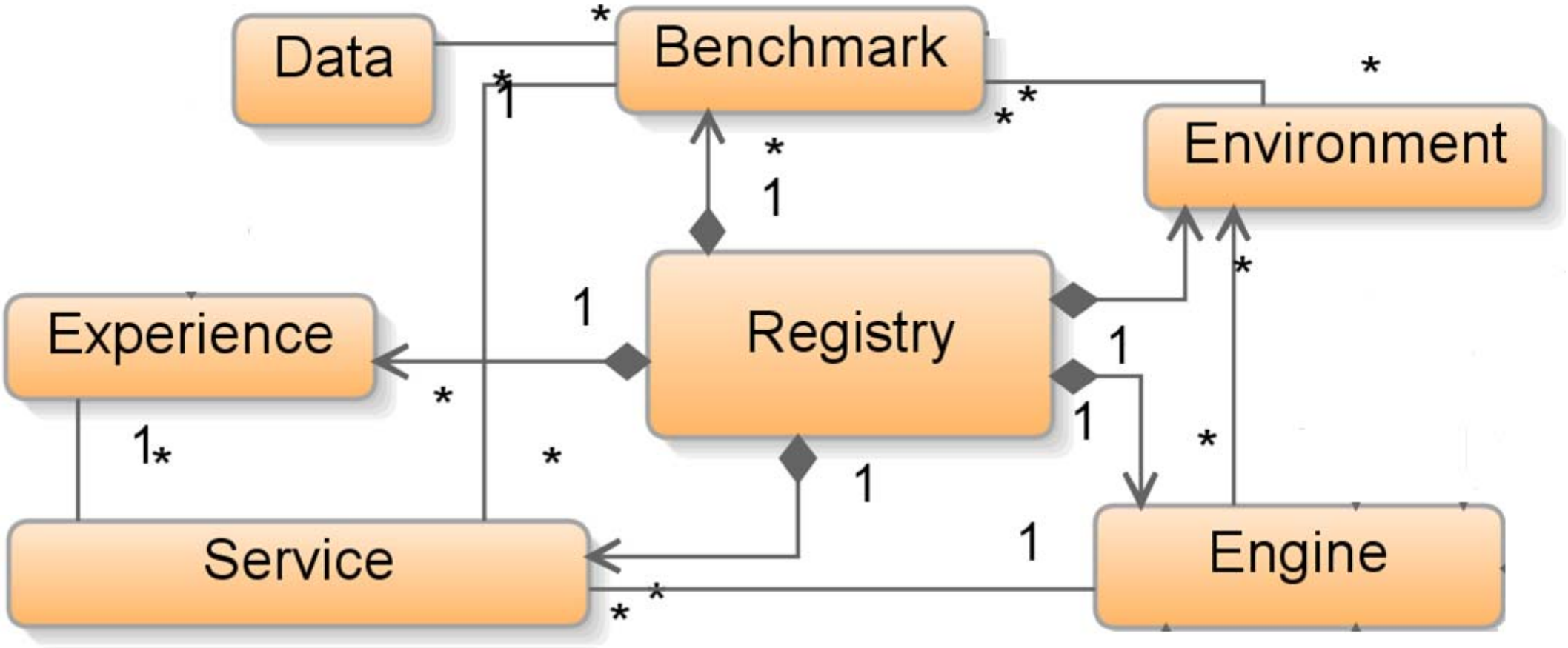
QoS measurement techniques

- Provider-side instrumentation
  - Invasive vs. Non-invasive
  - Access to code?
- Intermediaries
  - Traffic routed through them
- Probing
  - Independent party invokes services and collects QoS attributes
- Sniffing
  - Monitor traffic on client side

- Non-invasive provider-side service instrumentation
  - Automated monitoring of applications exposed as web services

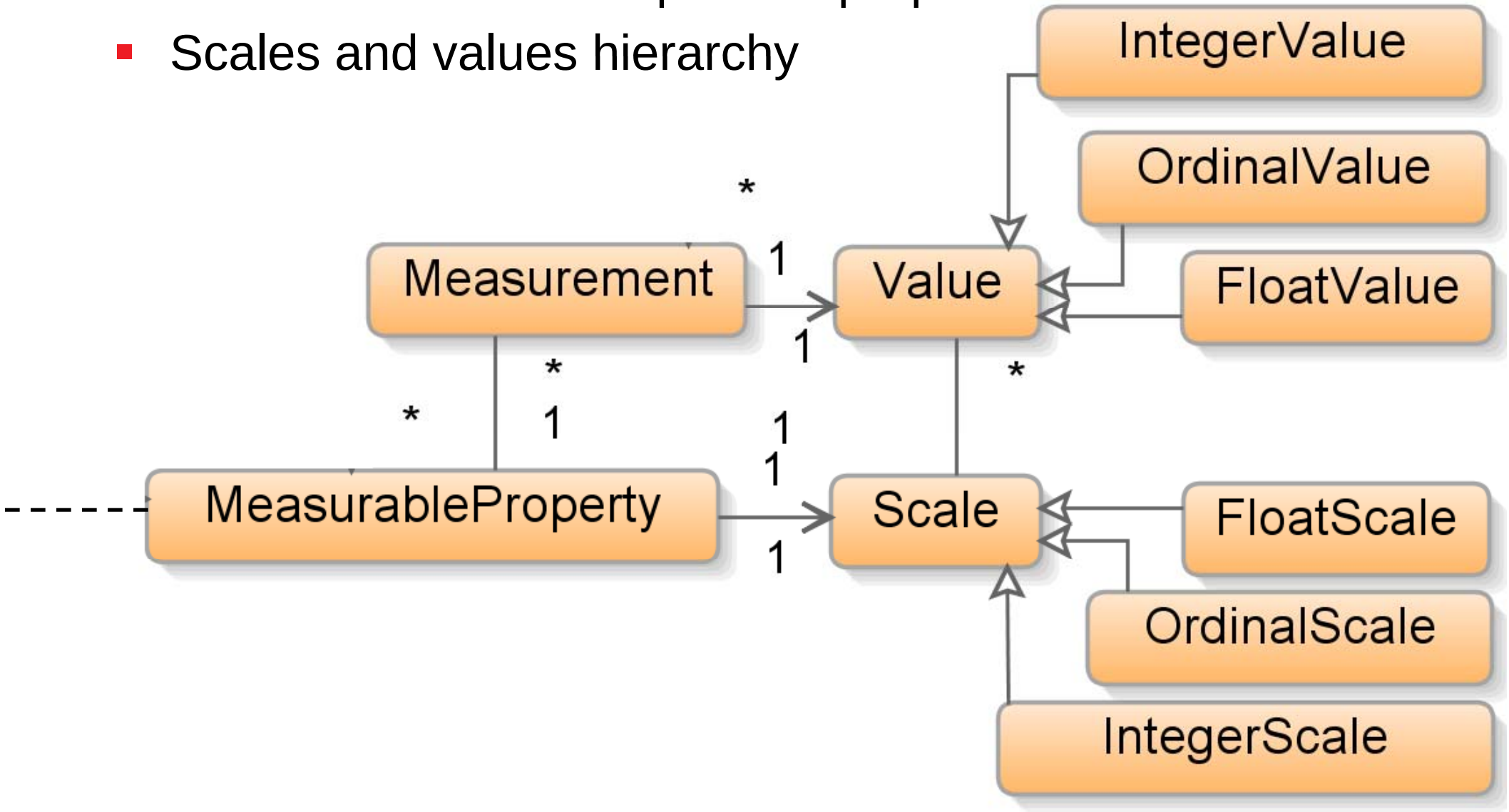
Core elements of the framework

- Engines make services quality-aware
- Environments have associated benchmark scores
- Registry accumulates experience



Measurements

- Specification of measurable properties per engine
- Measurements correspond to properties
- Scales and values hierarchy

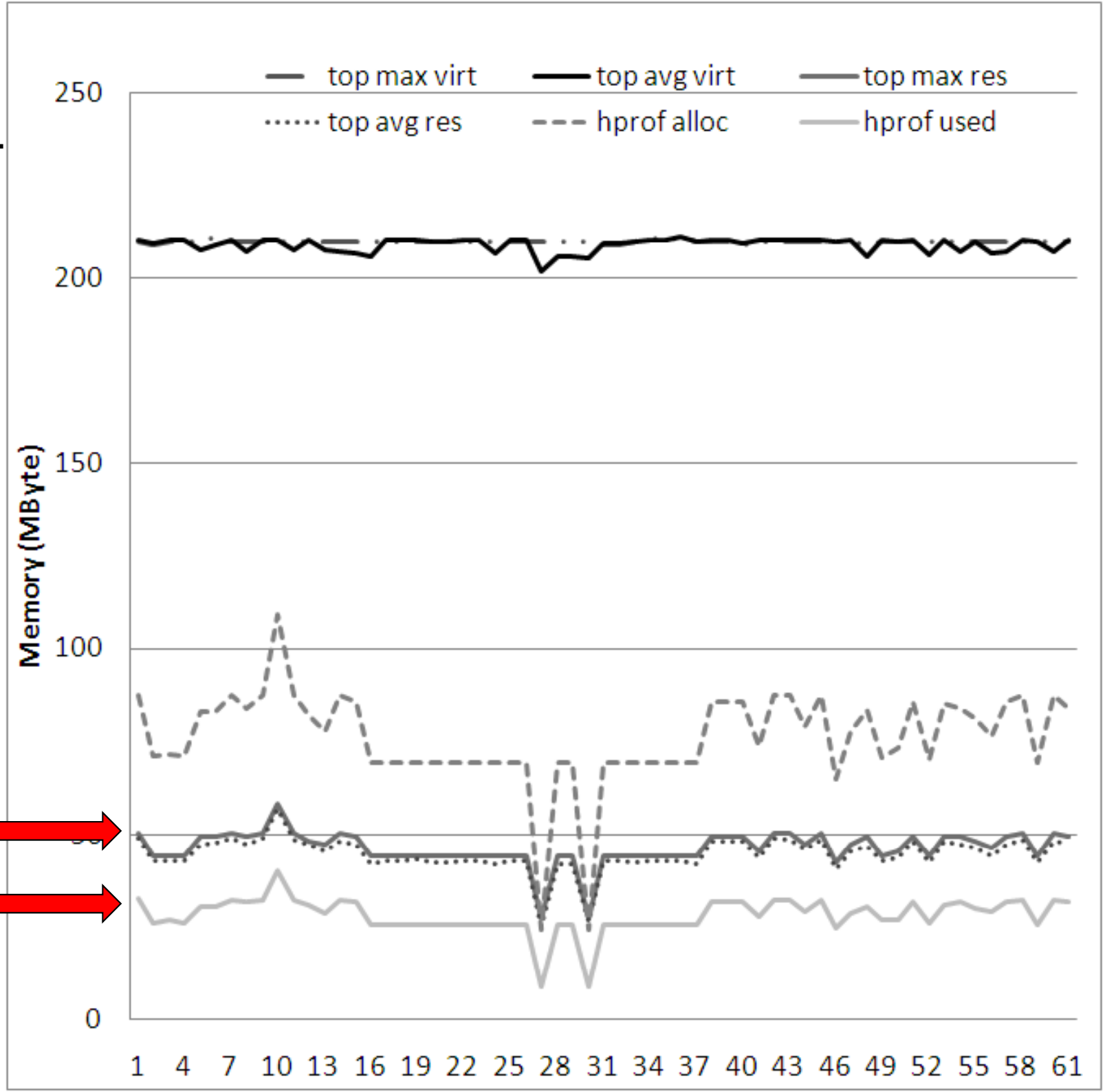


Types of engines

- Elapsed time
- Measuring CPU time and memory usage:
  - *nix: TOP, time
  - (new) Windows: PsList
  - Java: JIP, HPROF
- Measuring quality
  - XCL – eXtensible Characterisation Languages for measuring quality of object conversions in digital repositories
  - Other domain-specific QA tools for digital preservation
- Plugin structure: Additional engines can be added
- Composite Engine

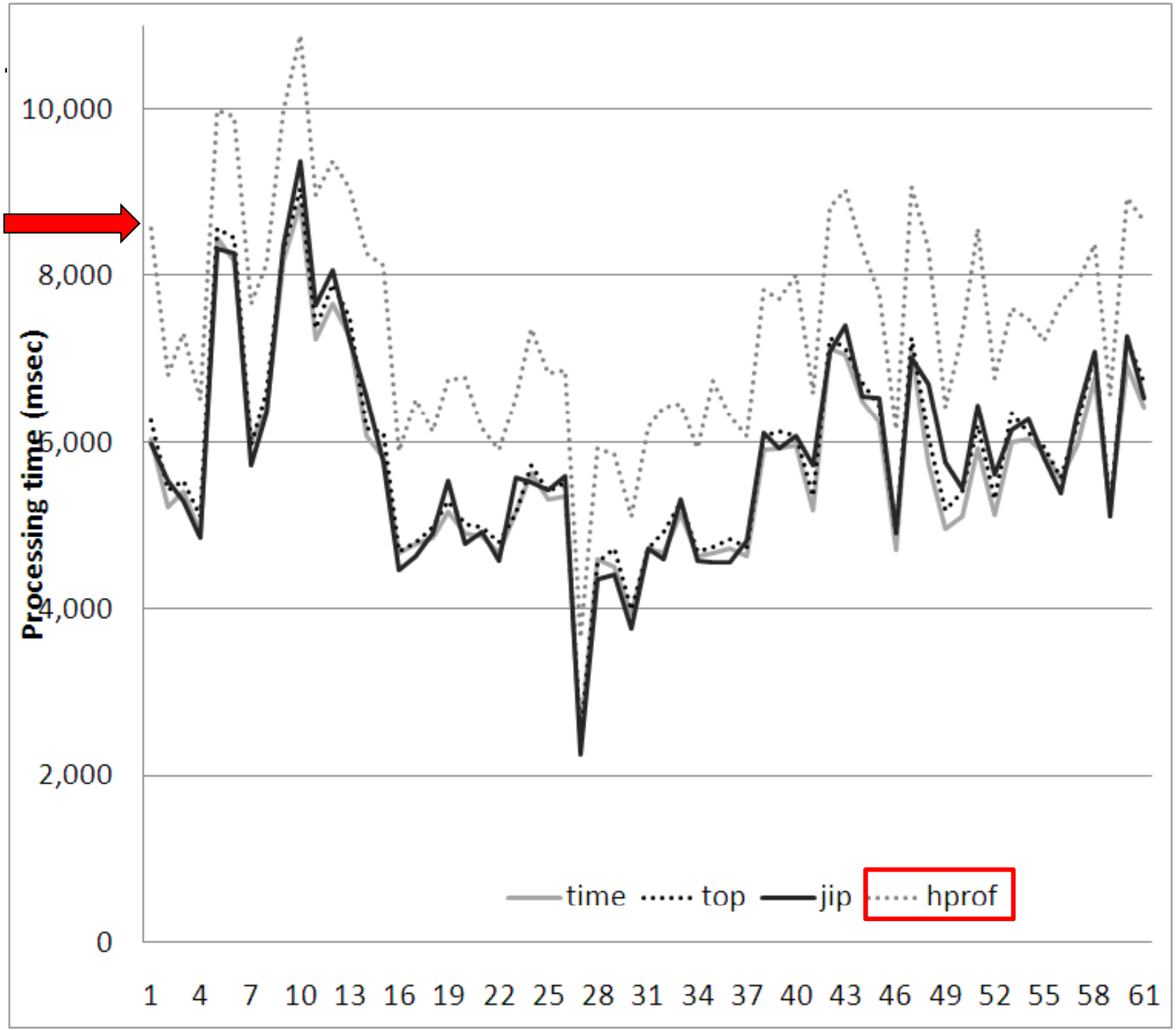
Profiling tools:

Memory usage of Java tools



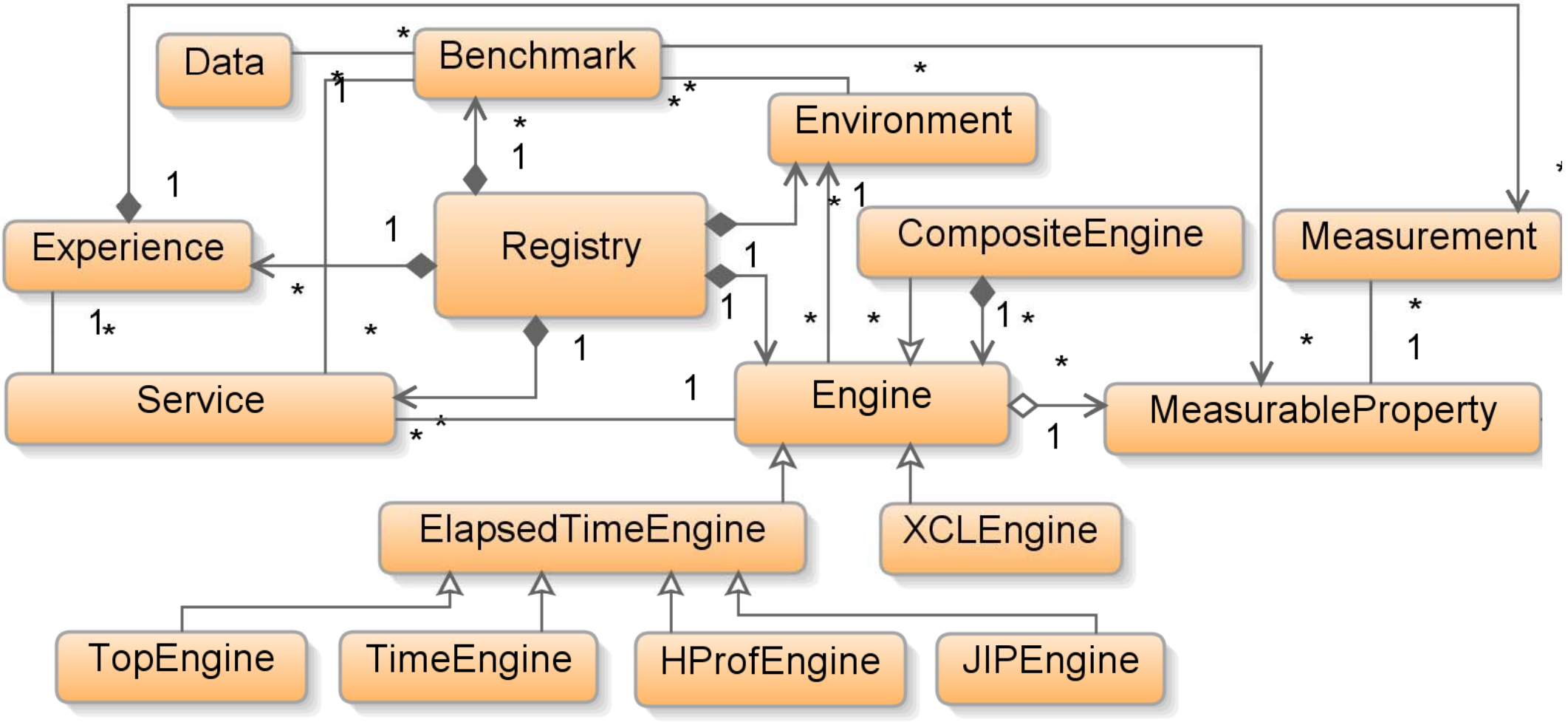
Profiling tools:

Timing of Java tools



Composite engine

- „Heisenberg principle“ in profiling
- Composite engine forks execution and collects results



Experiments

- Series of experiments on data conversion tools
- 50 to 300 files, 500-2800 MB input data volume
- Native applications on Linux and Windows
- Java programs
- Goals
  - Compare profiling tools
  - Select and verify metrics

  - Comparing performance
  - Accumulating experience
  - QoS tradeoffs

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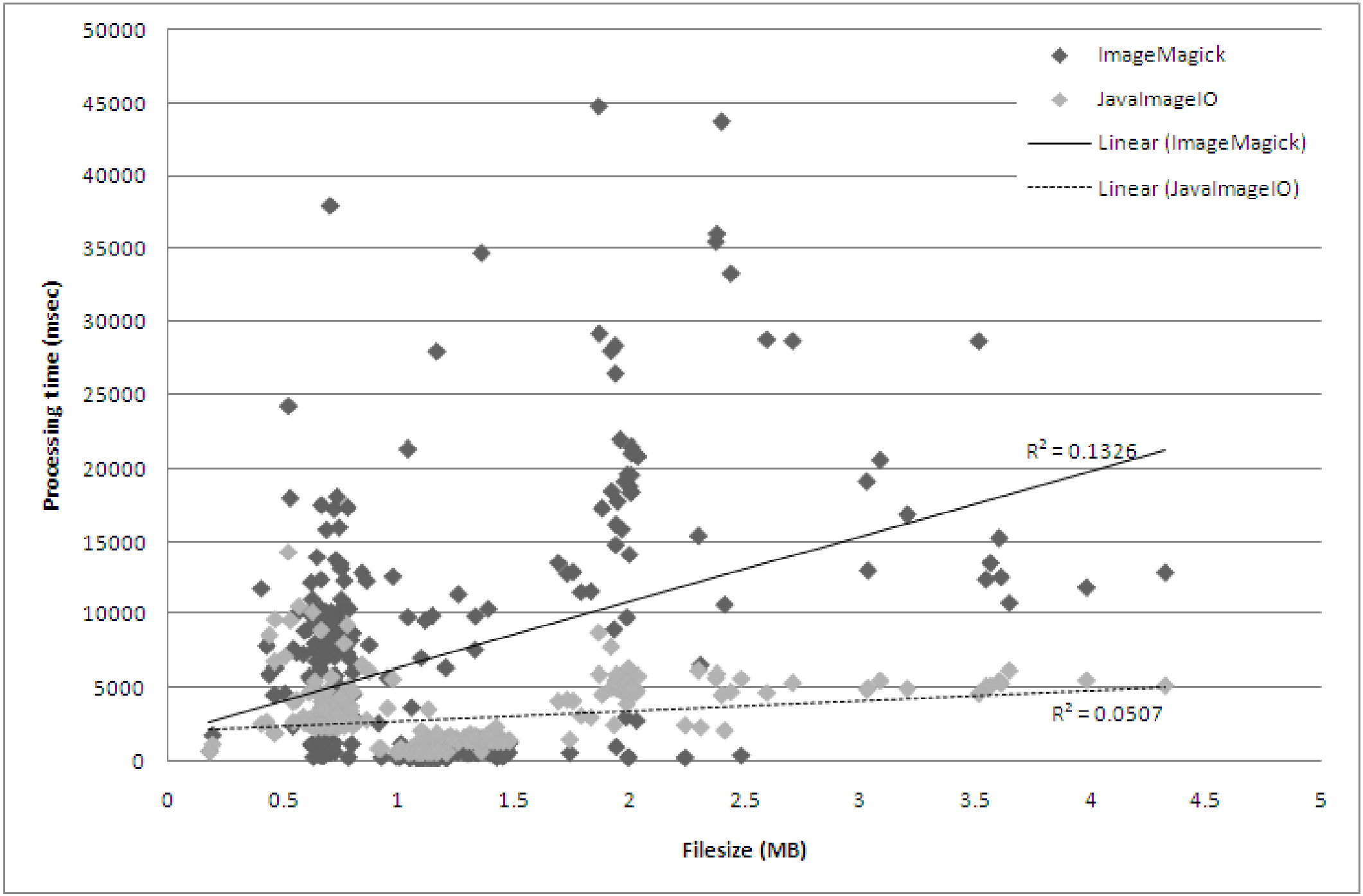
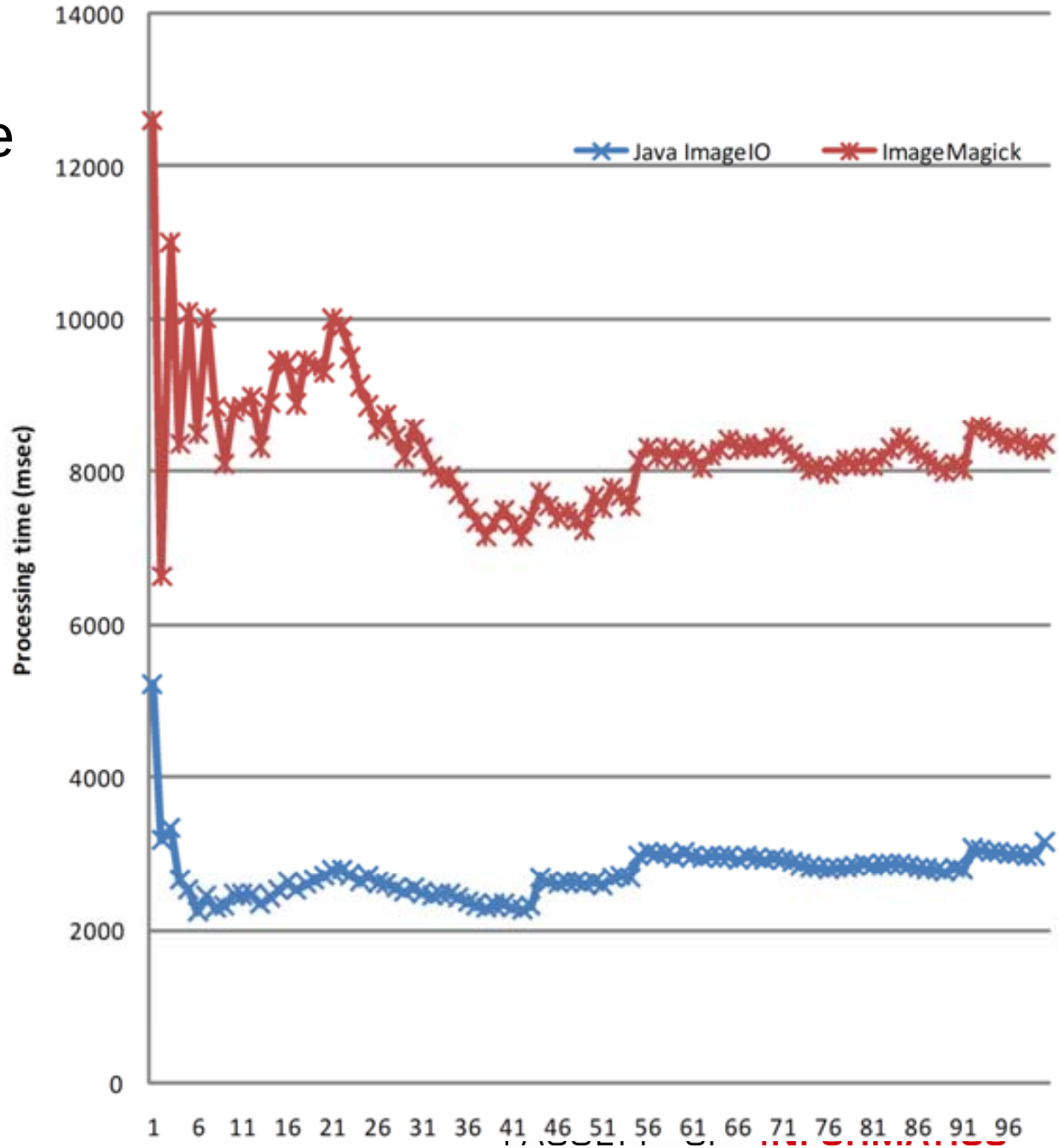
  - **Comparing performance**
  - **Accumulating experience**
  - QoS tradeoffs

Comparing tool performance



Accumulating experience

- Average processing time per MByte



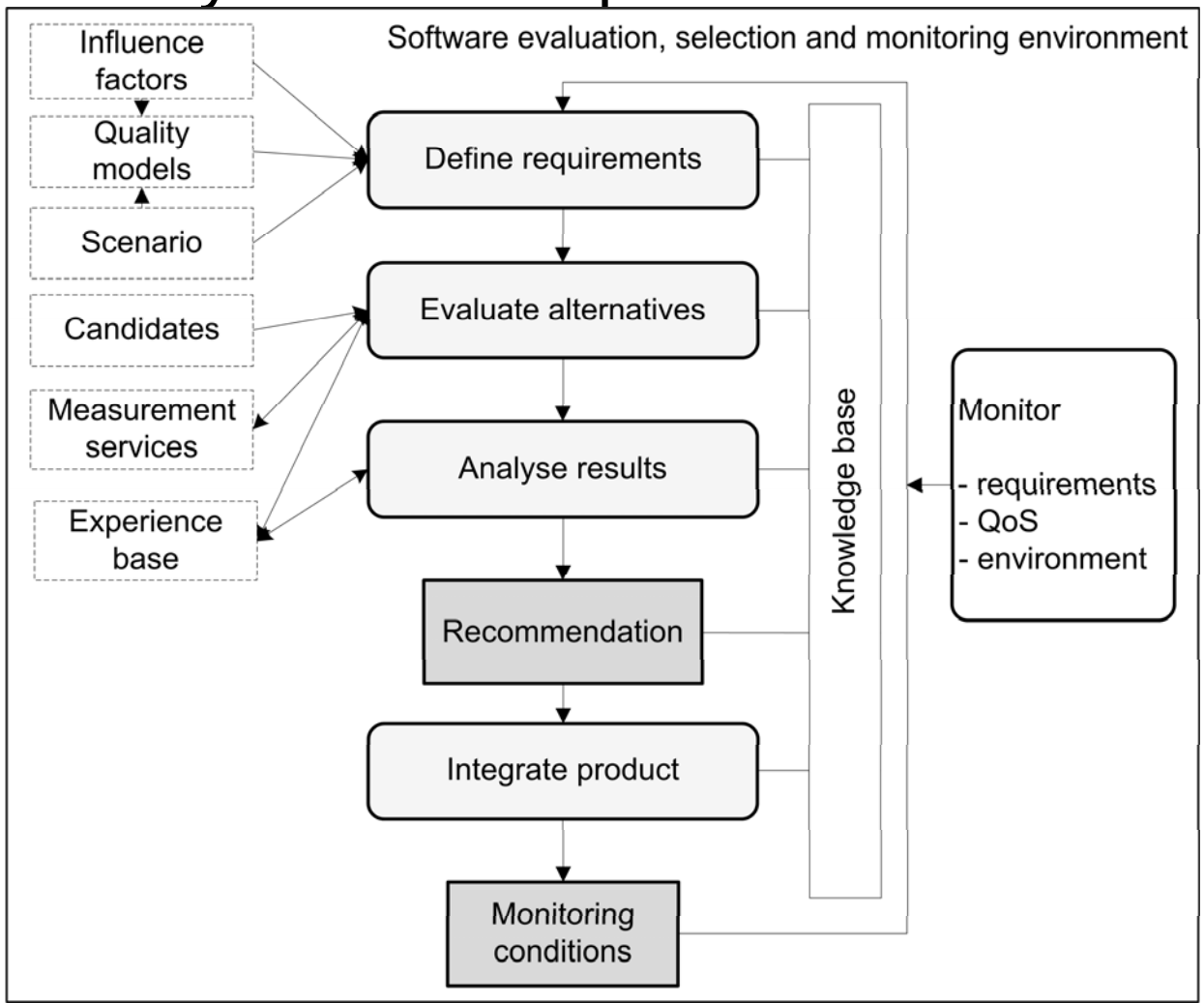
Client-side measurements

- Provider-side instrumentation does not cover network latency, (un)marshalling, protocol layers etc.
- Server- and client-side measurements complementary
- Additional client-side measurements
  - Allow feedback and accumulation of measurements
  - Prevent manipulation

- Each service response contains a generated key for adding client-side measurements

Automated evaluation

- Measurements returned as metadata
- Automated mapping to defined quality criteria
- Visualisation supports analysis and comparison
- Integration phase defines monitoring criteria
- Deployed components continually monitored



Visual analysis

- Planning tool **Plato** visualising results
- www.ifs.tuwien.ac.at/dp/plato

Results: Weighted multiplication

Result-Tree with all Alternatives, Aggregation method: Weighted multiplication
Expand All | Collapse All
National Library Publications

Focus	Name	Result
	⊟ National Library Publications	Adobe Acrobat->PDFA: 0.00 PdfMagiConversion: 3.44 Adobe Acrobat->HTML: 3.18
X	⊞ Object characteristics	Adobe Acrobat->PDFA: 1.55 PdfMagiConversion: 1.63 Adobe Acrobat->HTML: 1.52
X	⊞ Technical characteristics	Adobe Acrobat->PDFA: 1.14 PdfMagiConversion: 1.14 Adobe Acrobat->HTML: 1.16
X	⊟ Process Characteristics	Adobe Acrobat->PDFA: 0.00 PdfMagiConversion: 1.14 Adobe Acrobat->HTML: 1.08
	Duration	Adobe Acrobat->PDFA: 0.00 PdfMagiConversion: 1.23 Adobe Acrobat->HTML: 1.06
	Automation of the process	Adobe Acrobat->PDFA: 1.55 PdfMagiConversion: 1.90 Adobe Acrobat->HTML: 1.55
X	⊞ Integrity	Adobe Acrobat->PDFA: 1.00 PdfMagiConversion: 1.00 Adobe Acrobat->HTML: 1.00
X	⊞ Costs	Adobe Acrobat->PDFA: 1.67 PdfMagiConversion: 1.63 Adobe Acrobat->HTML: 1.67

Questions?

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