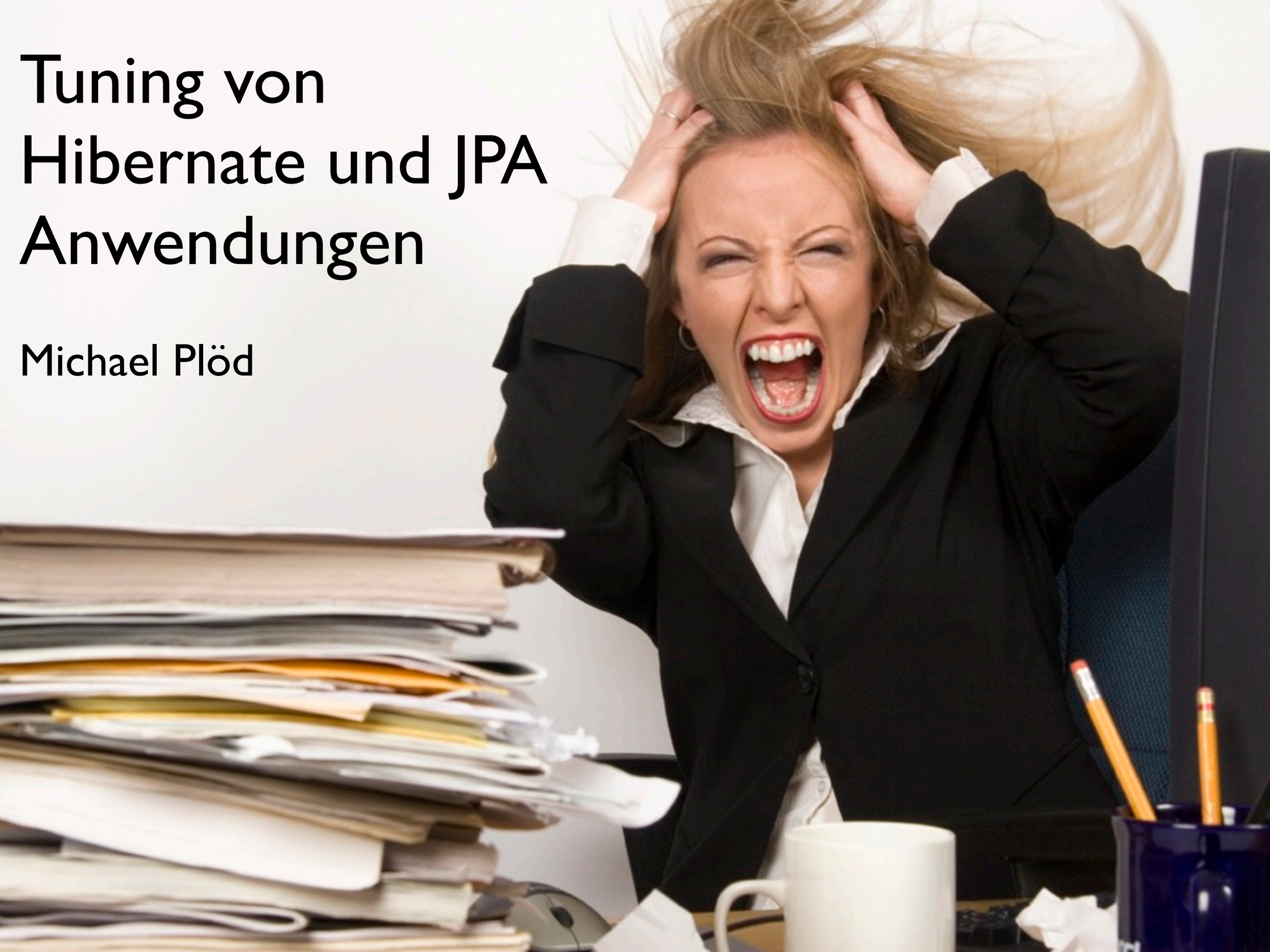
Ihre Persistenzschicht?

Kunde, Chef, DBA?

Tuning von Hibernate und JPA Anwendungen

Michael Plöd



Michael Plöd

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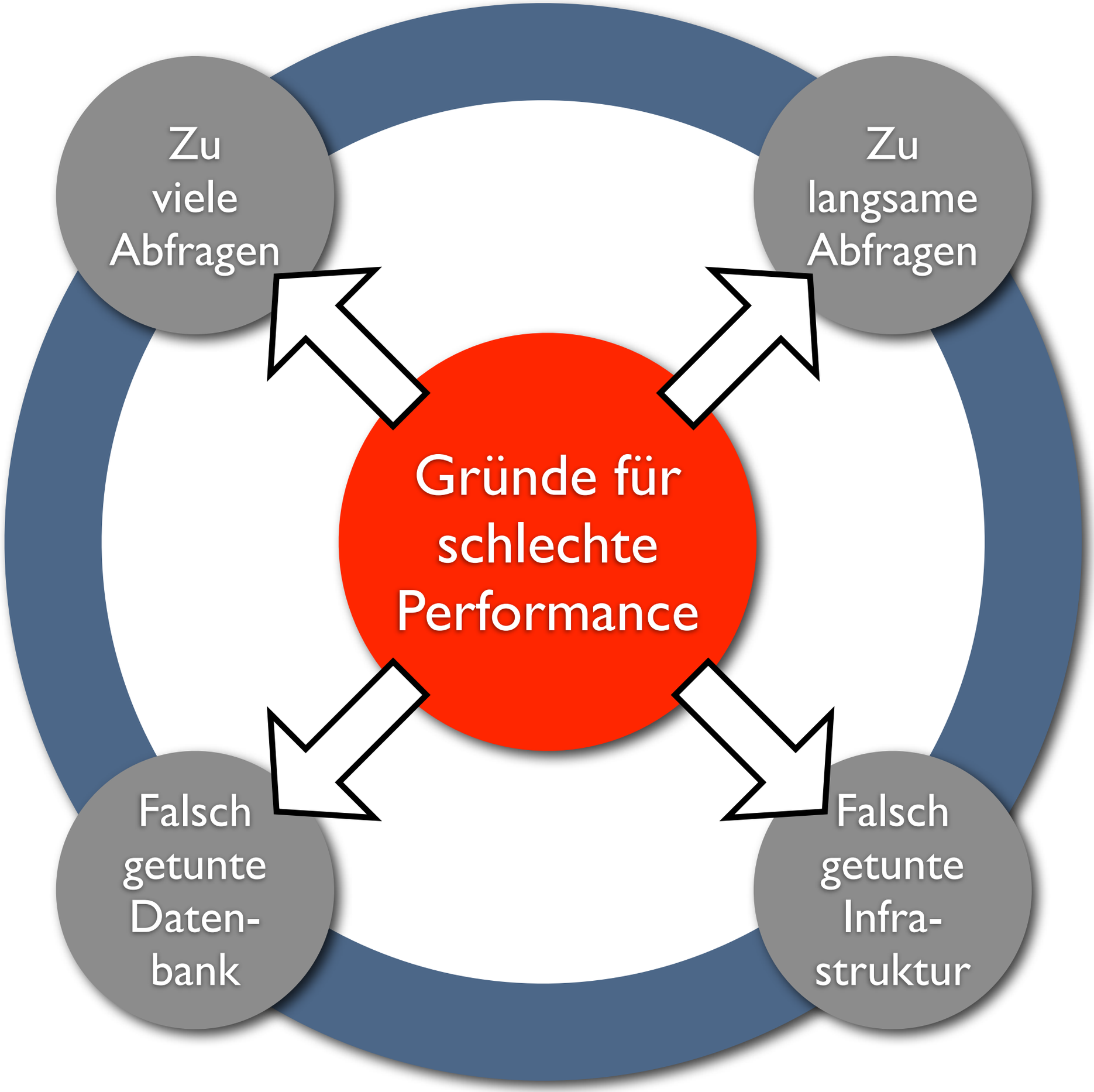
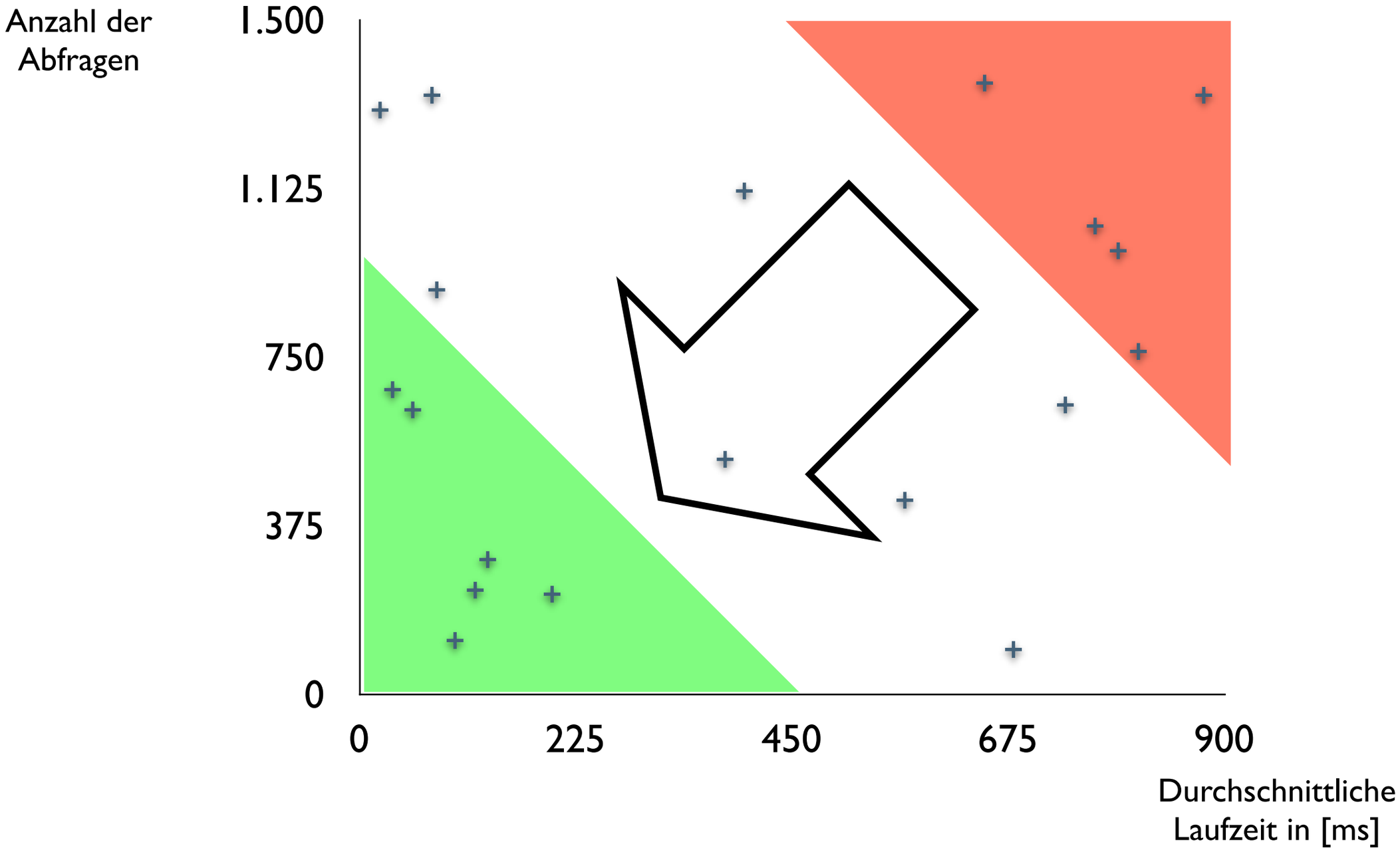
- michael.ploed@senacor.com
- http://rockingcode.blogspot.com
- Twitter: @bitboss

IST ORM

LANGSAM


Zu viele Abfragen
Zu langsame Abfragen
Gründe für schlechte Performance
Falsch getunte Daten-bank
Falsch getunte Infra-struktur

Klassifizierung von Abfragen



Ursachen

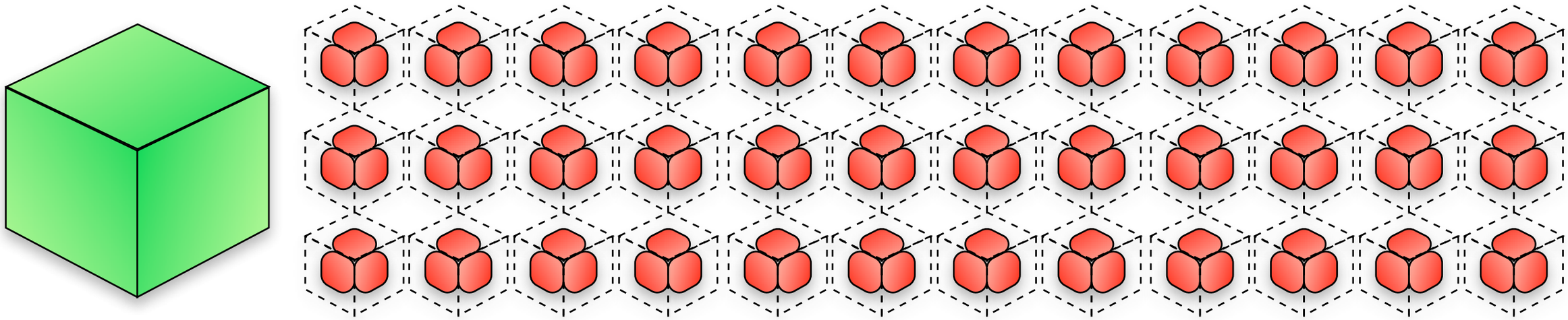
Hohe Häufigkeit

- ★ Applikations-Logik
- ★ Mappings
- ★ Kein Caching
- ★ N+1 Selects Problem

Hohe Laufzeit

- ★ Zu hohe Selektivität
- ★ Variablen-Übergabe
- ★ Fehlende Indizes
- ★ Karthesisches Produkt
- ★ Locks
- ★ Datenbankstruktur

N+1 Selects Problem



```
List list = s.createCriteria(Konto.class).list();
for (Iterator it = list.iterator(); it.hasNext();) {
  Konto kto = (Konto) it.next();
  kto.getKunde().getName();
}
```

```
SELECT * FROM KONTEN                                  +1
SELECT * FROM PERSONEN WHERE PERSON_ID = ?
SELECT * FROM PERSONEN WHERE PERSON_ID = ?            N
SELECT * FROM PERSONEN WHERE PERSON_ID = ?
...
```

Karthesisches Produkt

```
@Entity
public class Konto {
 ...
 @OneToMany(fetch=FetchType.EAGER)
 public Set<Buchung> getBuchungen() {...}

 @OneToMany(fetch=FetchType.EAGER)
 public Set<Vollmacht> getVollmachten() {...}
 ...
}
```

```
select konto.*, buchung.*, vollmacht.*
  from KONTEN konto
  left outer join BUCHUNGEN buchung
     on konto.ID = buchung.KTO_ID
  left outer join VOLLMACHTEN vollmacht
     on konto.ID = vollmacht.KTO_ID
```

Karthesisches Produkt

```
select konto.*, buchung.*, vollmacht.*
  from KONTEN konto
  left outer join BUCHUNGEN buchung
     on konto.KTO_ID = buchung.KTO_ID
  left outer join VOLLMACHTEN vollmacht
     on konto.KTO_ID = vollmacht.KTO_ID
```

KTO_ID	KTO_NR	...	BUCH_ID	BUCH_BETRAG	...	VM_ID	VM_NAME	...
1	12344	...	10	1000,00 €	...	200	Michael Plöd	...
1	12344	...	10	1000,00 €	...	300	Martin Plöd	...
1	12344	...	20	-324,23 €	...	200	Michael Plöd	...
1	12344	...	20	-324,23 €	...	300	Martin Plöd	...
1	12344	...	30	543,11 €	...	200	Michael Plöd	...
1	12344	...	30	543,11 €	...	300	Martin Plöd	...
2	21300	...	40	-4323,23 €	...	400	Sandra Ulrich	...
2	21300	...	40	-4323,23 €	...	400	Melanie Ulrich	...
2	21300	...	40	-4323,23 €	...	400	Herbert Ulrich	...
...	...	...	...	...	...	...	...	...

Gutes

TUNING

ist

IMMER

eine Frage der

BALANCE

FETCHING

- ★ Batch
- ★ Subselect
- ★ Eager

CACHING

- ★ 1st Level Cache
- ★ 2nd Level Cache
- ★ Stateless Session

ABFRAGEN

- ★ Selektivität
- ★ Query Cache
- ★ Bind Variablen

LOGIK

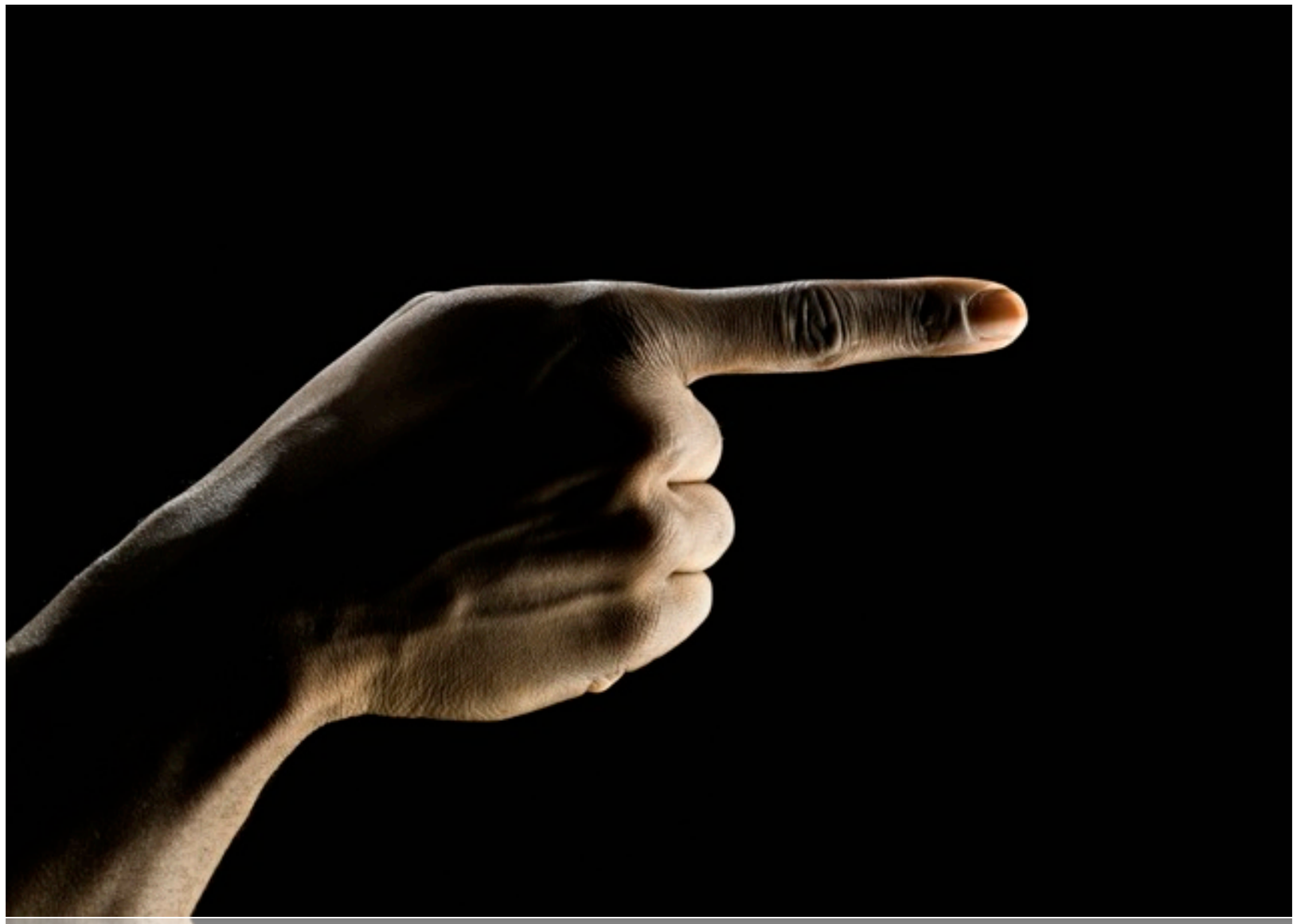
- ★ Schleifen
- ★ Datenmenge

LOCKS

- ★ Optimistic Locking

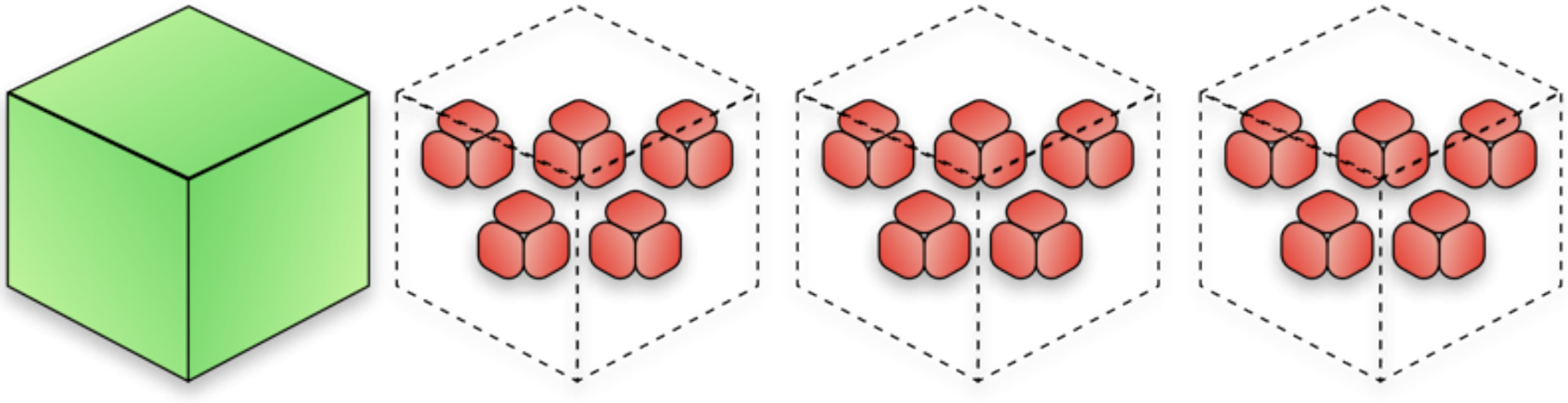
Runtime

- ★ DB Entwurf
- ★ Konfiguration
- ★ Connection Pool



Mappings

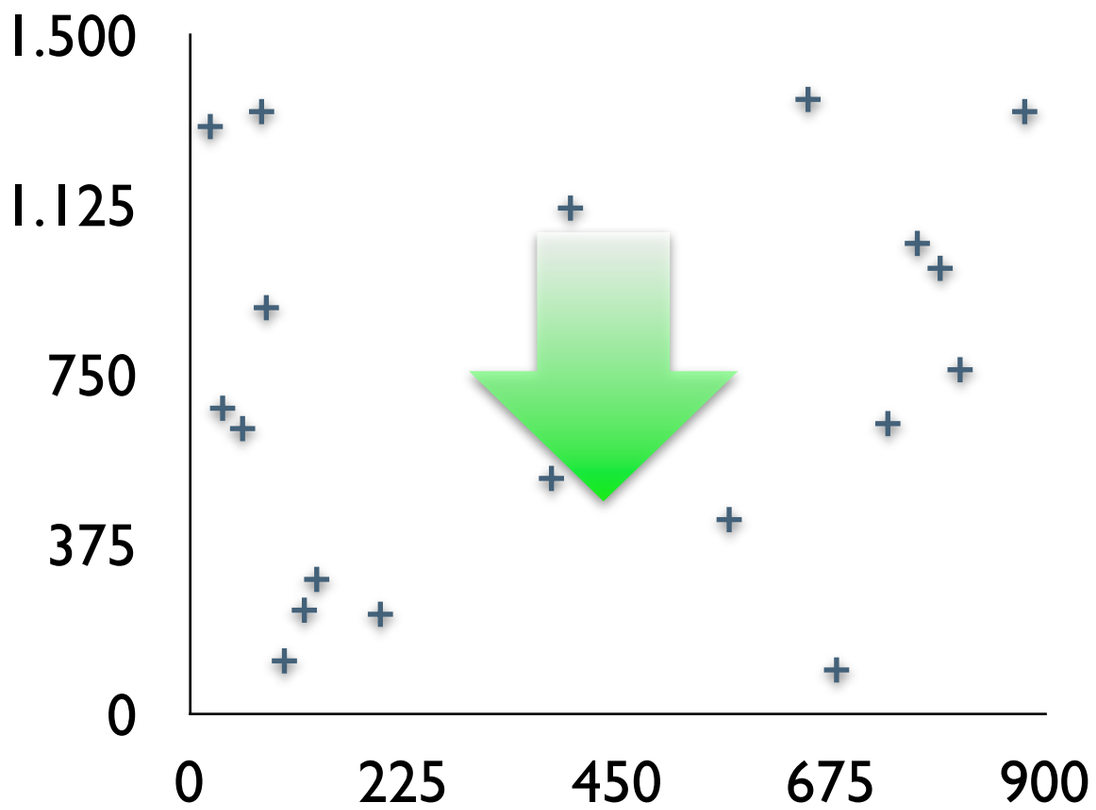
Batch Fetching



```
@Entity
public class Konto {
 @ManyToOne(...)
 public Person getKunde()
 {...}
 ...
}
@Entity
@BatchSize(size=5)
public class Person {
 ...
}
```

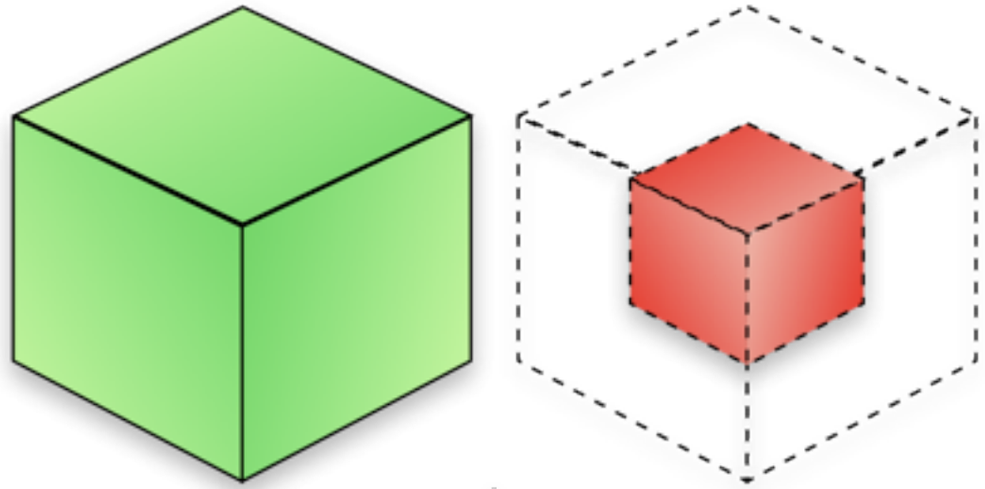
```
SELECT k.* FROM KONTEN k

SELECT * FROM PERSONEN
WHERE PERSON_ID IN (?, ?, ?, ?, ?)

SELECT * FROM PERSONEN
WHERE PERSON_ID IN (?, ?, ?, ?, ?)

SELECT * FROM PERSONEN
WHERE PERSON_ID IN (?, ?, ?)
```

Batch Fetching



- ★ Schätzung
- ★ Einfach
- ★ Lazy
- ★ (N / Batch Size) + 1

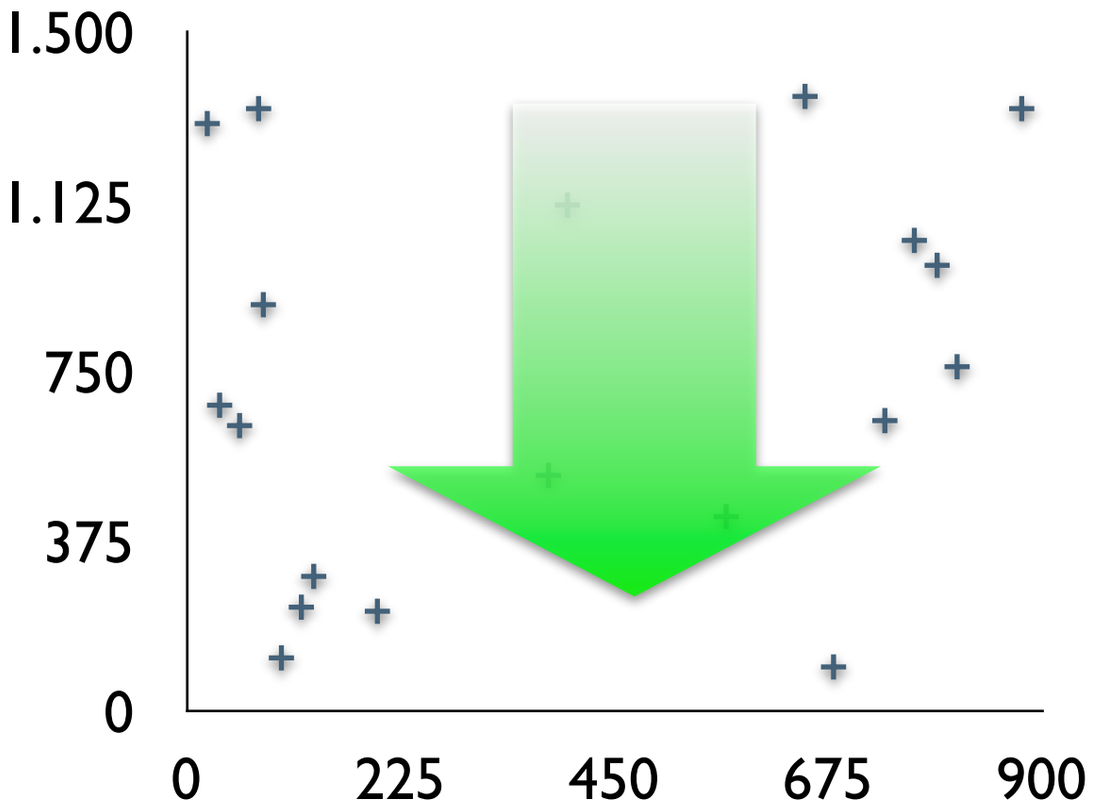
Subselect Fetching



```
@Entity
public class Konto {
 @OneToMany
 @Fetch(FetchMode.SUBSELECT)
 public Set getBuchungen()
 {...}
 ...
}
```

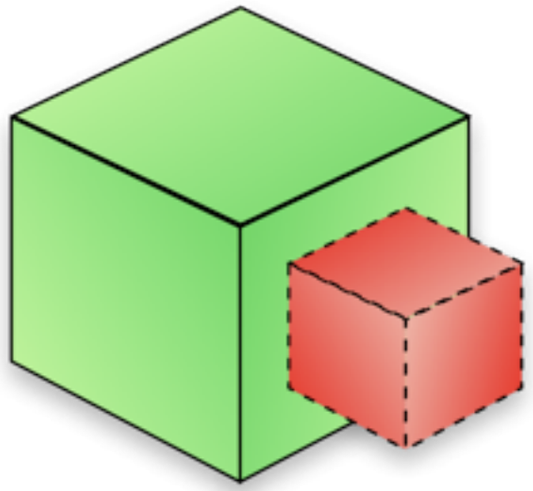
```
SELECT k.* FROM KONTEN k

SELECT b.* FROM BUCHUNGEN b
WHERE b.KTO_ID IN (
   SELECT k.KTO_ID FROM KONTEN k
)
```

Subselect Fetching



- ★ Nur für Collections
- ★ Keine Schätzung
- ★ Einfach
- ★ Lazy
- ★ 2 Abfragen

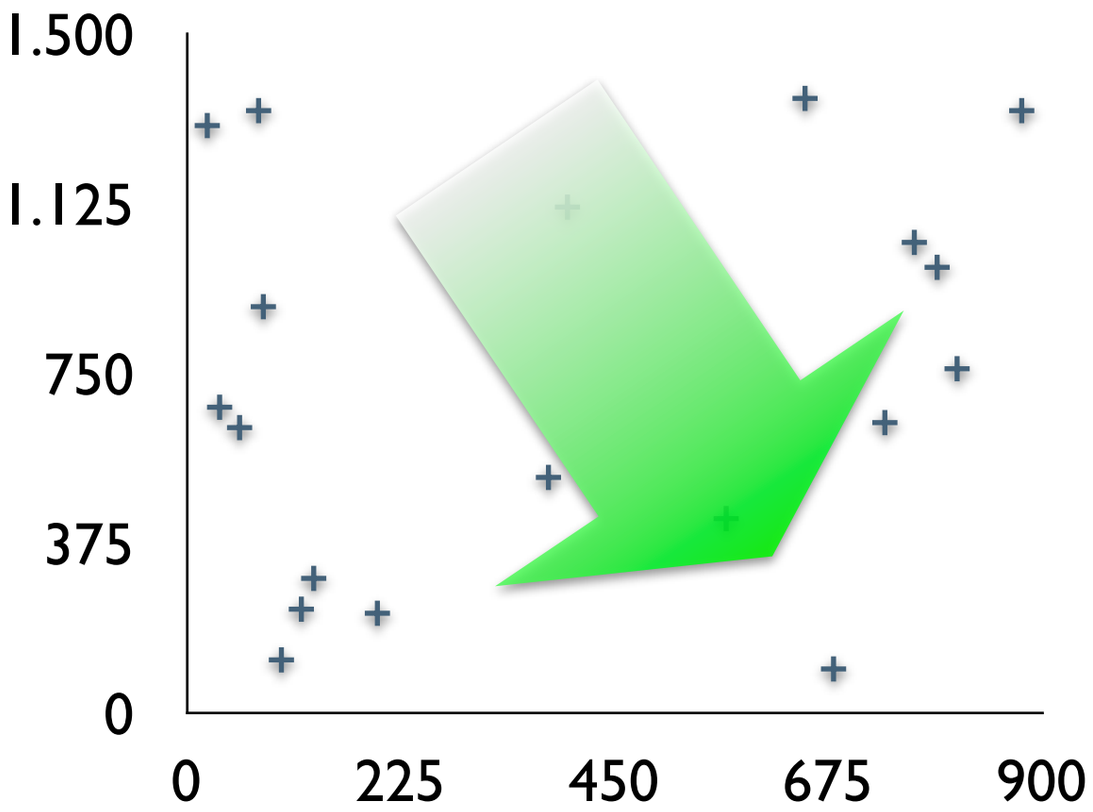
Eager Fetching



```
@Entity
public class Konto {
 @OneToMany(
    fetch = FetchType.EAGER
 )
 public Set getBuchungen()
 {...}

 @ManyToOne(
    fetch = FetchType.EAGER
 )
 public Kunde getEigentuemer()
 {...}
}
```

```
SELECT ko.*, b.*, ku.*
  FROM KONTEN ko
  LEFT OUTER JOIN BUCHUNGEN b
    on b.KTO_ID = ko.KTO_ID
  LEFT OUTER JOIN KUNDEN ku
    on ko.KU_ID = ku.KU_ID
```

Eager Fetching

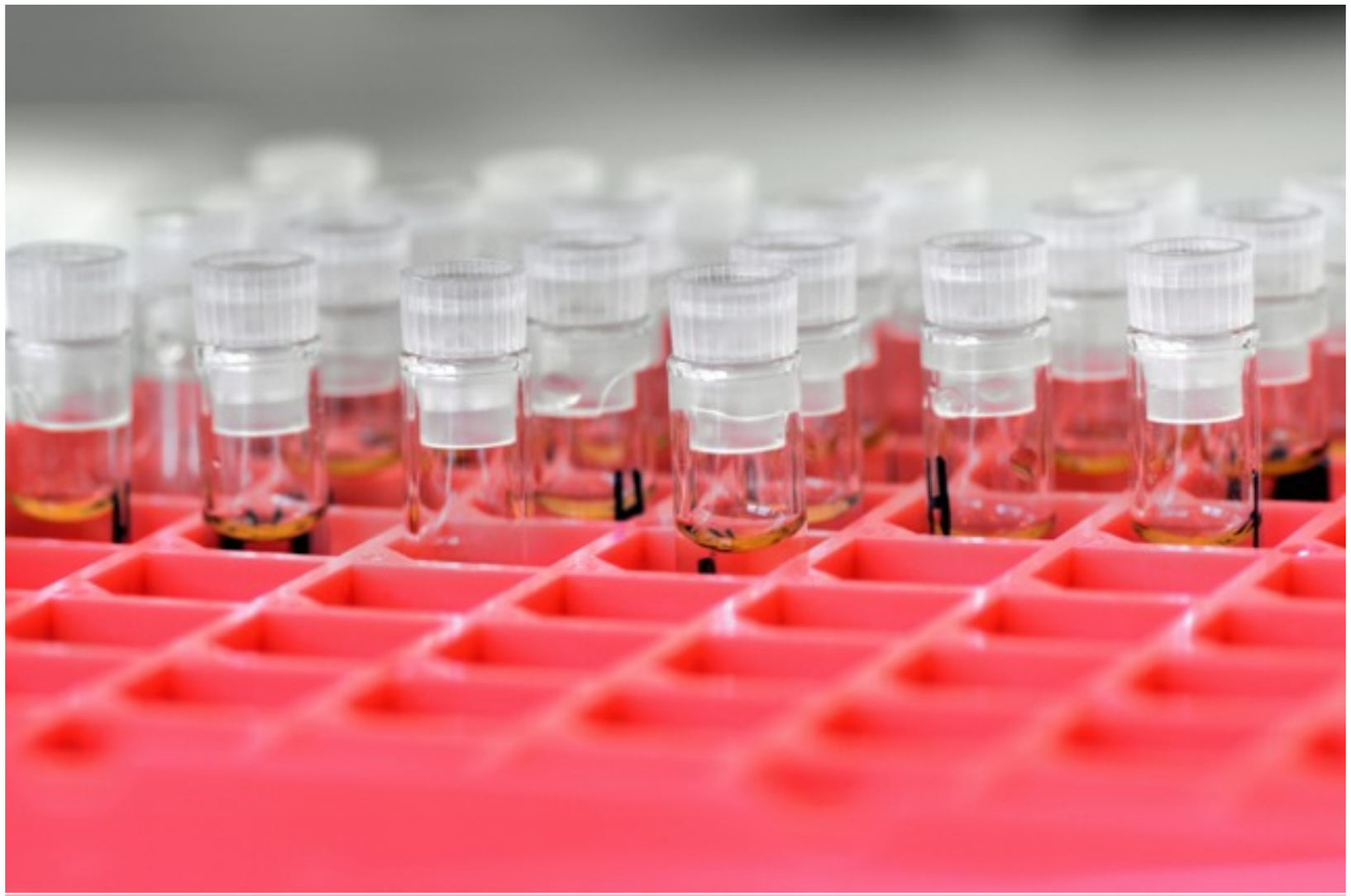


★ Nie bei 2+ Collections!

★ Nicht Lazy

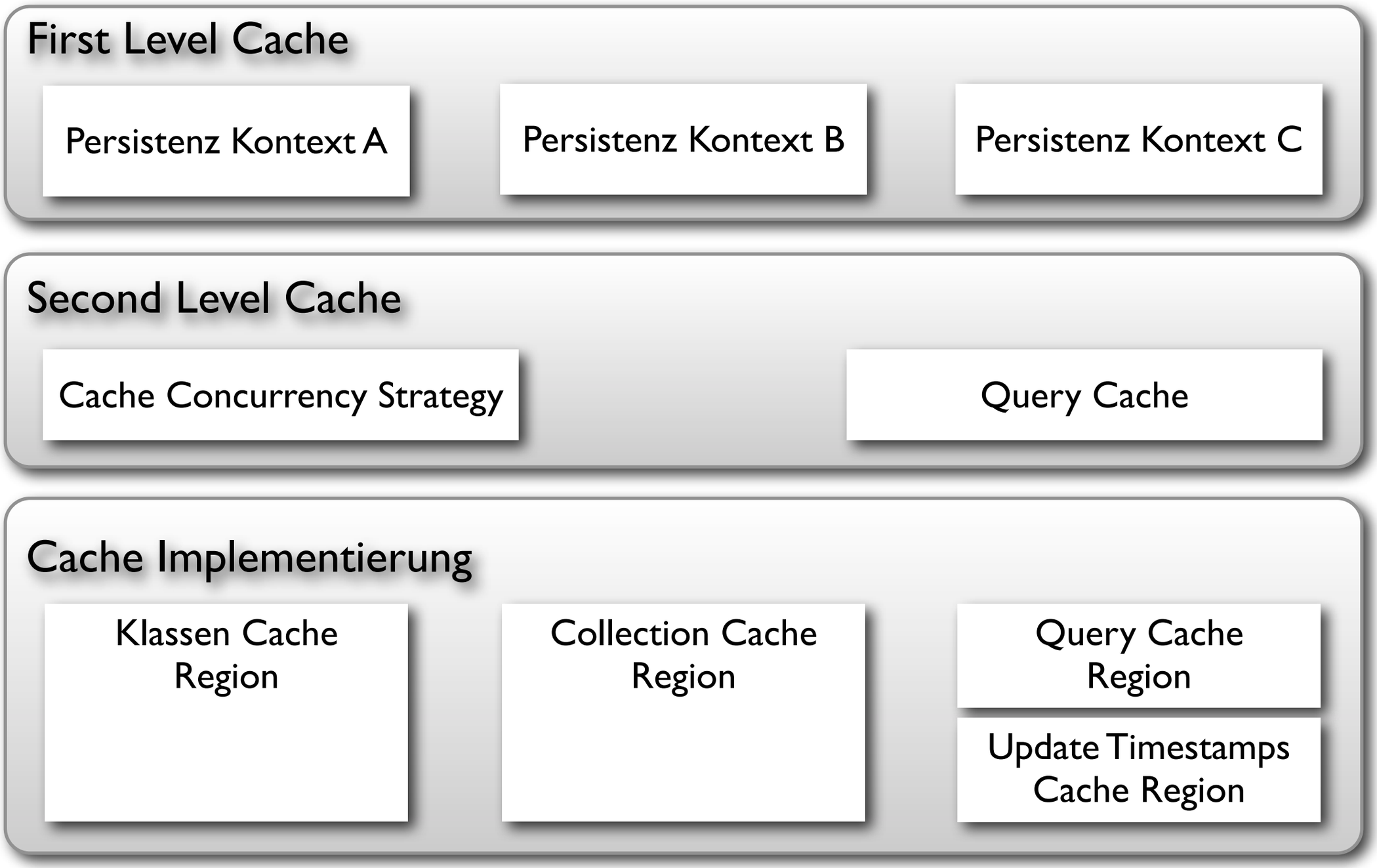
★ 1 Abfrage

★ Nie in globalen Fetch Plan aufnehmen



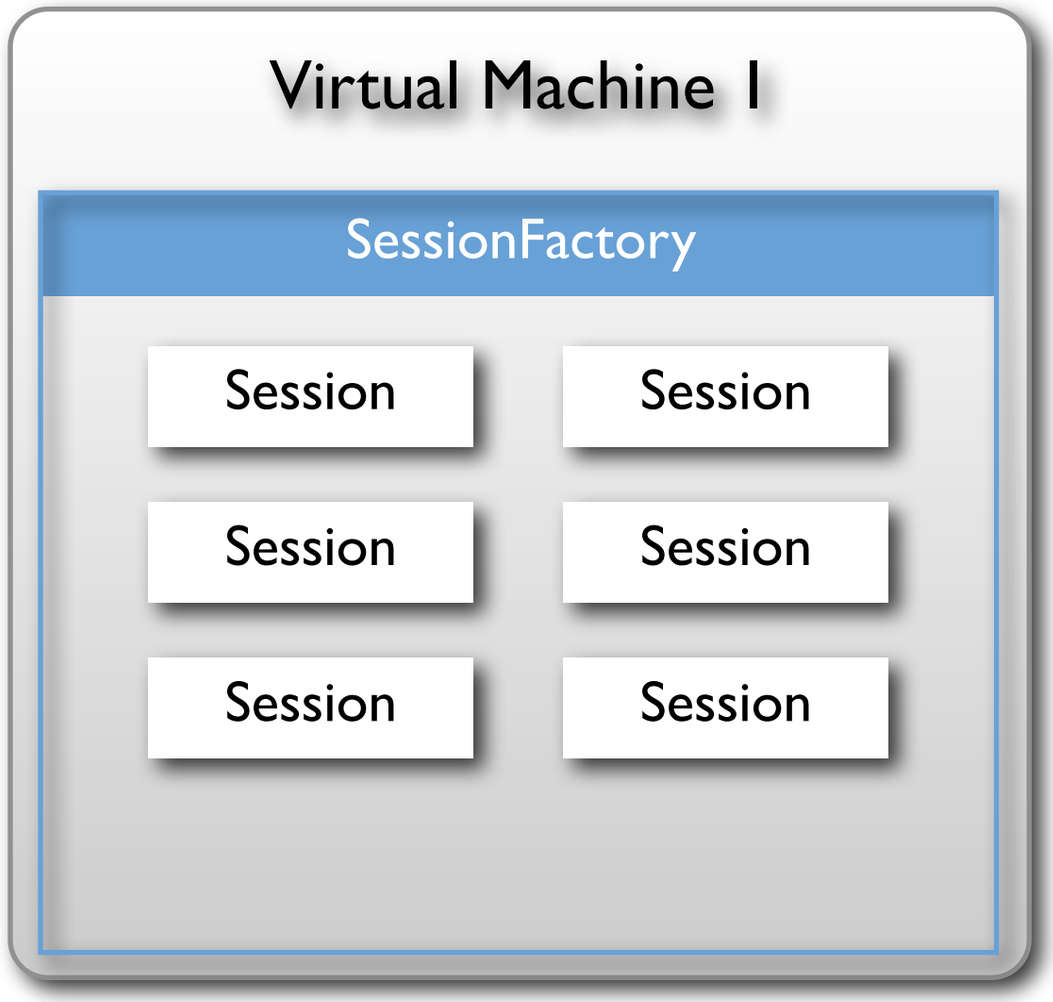
Caching

Caching Architektur



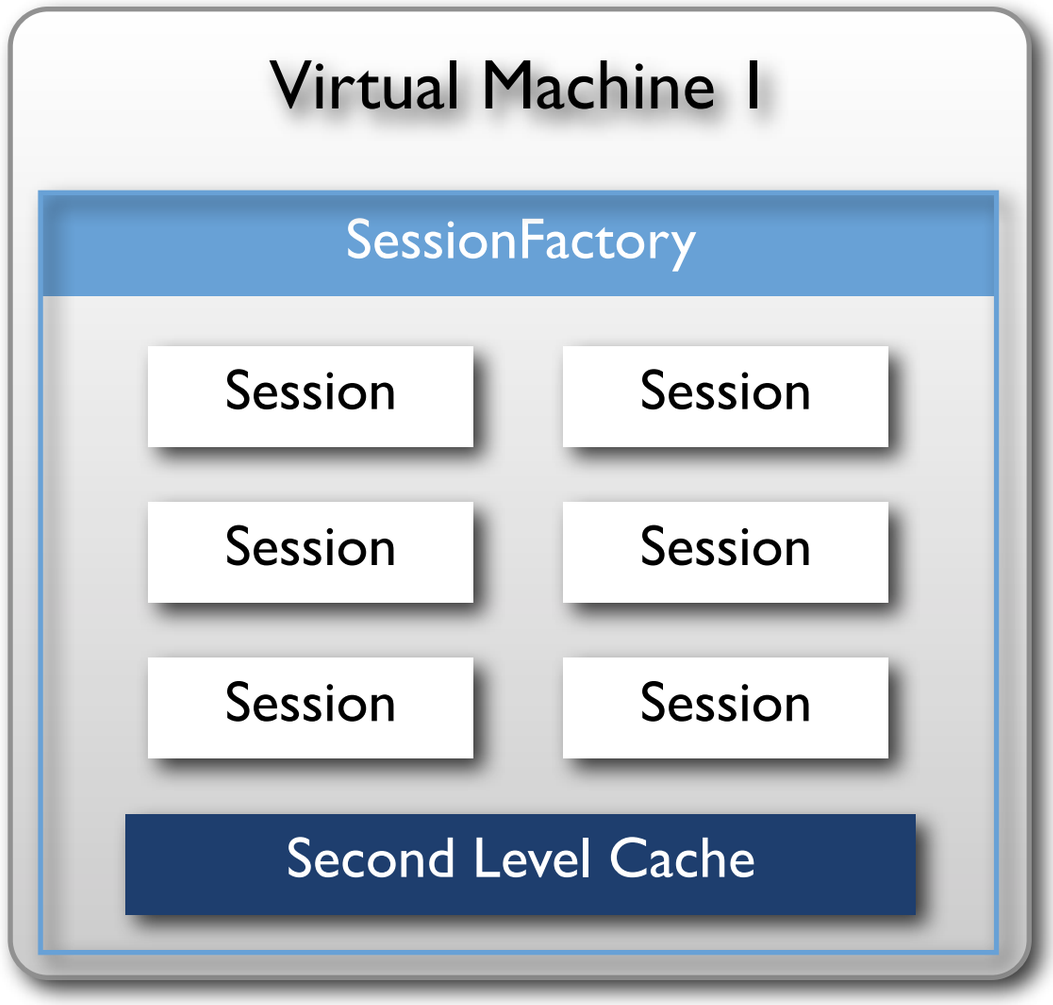
Infrastruktur

1st Level Cache only



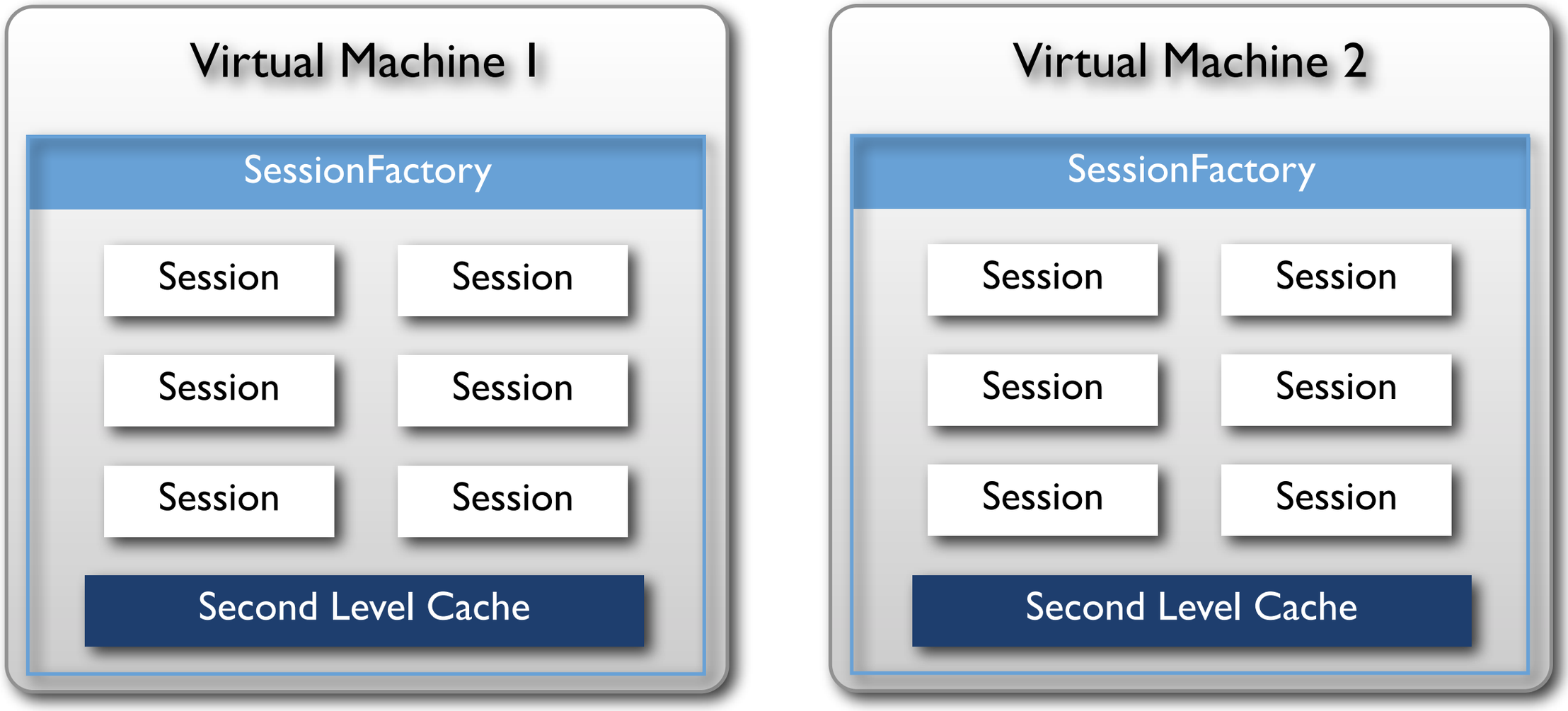
Infrastruktur

Lokale 2nd Level Caches



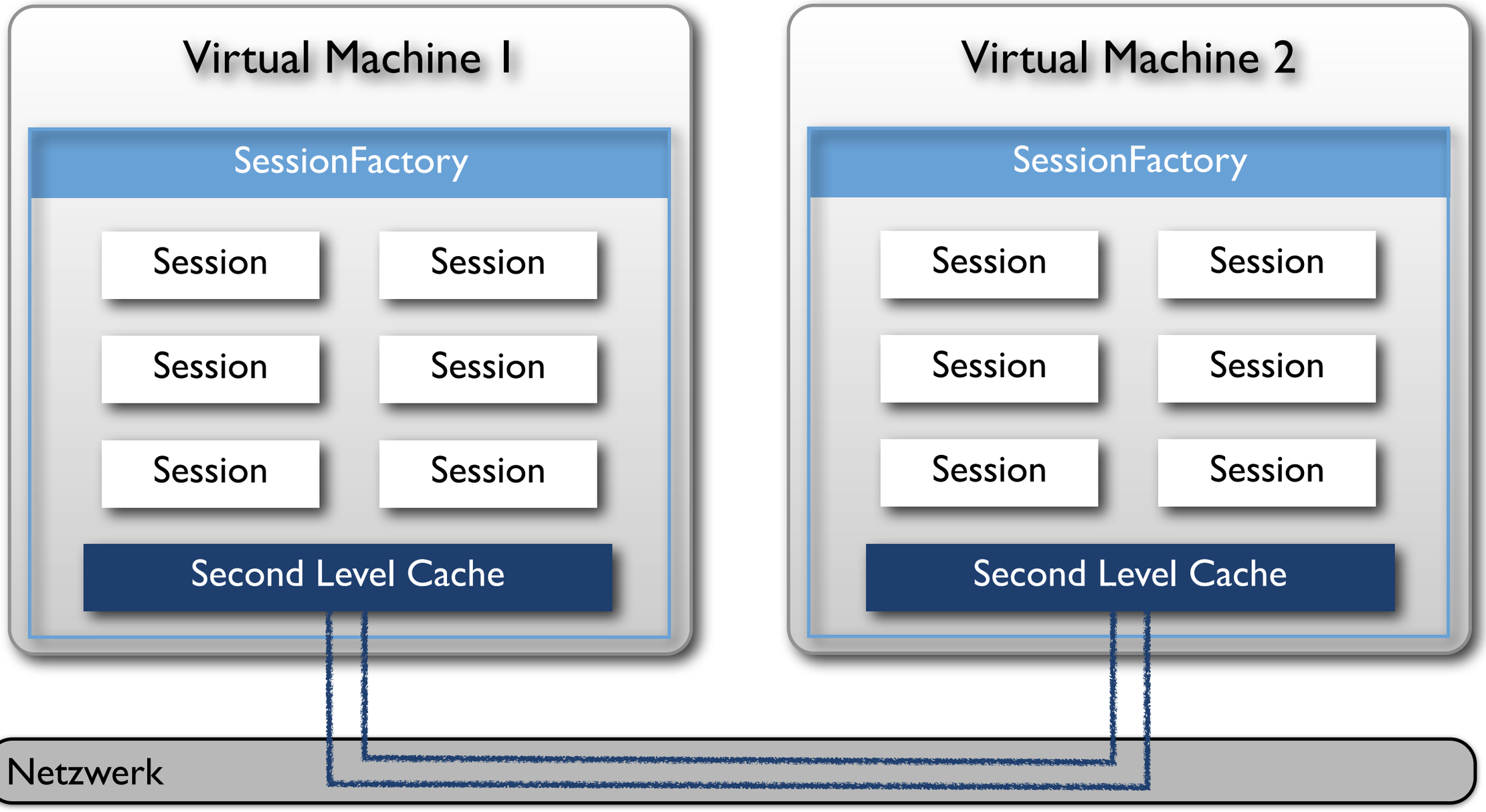
Infrastruktur

Lokale 2nd Level Caches



Infrastruktur

Verteilter Second Level Cache



Welche

EXCEPTION

bekomme ich, wenn ich

10.000.000 Objekte lade?

OutOfMemory

Hibernate verwaltet den **1st Level Cache** nicht von selbst!

Grundregeln

- ★ ORM ist kein Batch Tool!
- ★ Bei Massen-Verarbeitung regelmässig flushen und clearen!
- ★ JDBC Batch-Size anpassen

```
for ( int i=0; i<100000; i++ ) {
    Konto konto = new Konto(...);
    session.save(konto);
    if ( i % 50 == 0 ) {
        session.flush();
        session.clear();
    }
}
```

Concurrency Strategies

Transactional	Isolation bis zu **repeatable read**
Read-Write	Isolation bis zu **read commited**
Nonstrict-read-write	Keine Konsistenz Garantie, aber Timeouts
Read-only	Nur für Daten, die sich **nie** ändern

Cache Provider

	Transactional	Read-write	Nonstrict Read-write	Read-only
EHCache		x	x	x
OSCache		x	x	x
SwarmCache			x	x
JBoss Cache	x			x

Konfiguration

org.hibernate.cache.provider_class

EHCache	org.hibernate.cache.EhCacheProvider
OSCache	org.hibernate.cache.OsCacheProvider
SwarmCache	org.hibernate.cache.SwarmCacheProvider
JBoss Cache	org.hibernate.cache.TreeCacheProvider

Mappings

- ★ Annotation:
  @Cache(usage=CacheConcurrencyStrategy.READ_WRITE)
- ★ XML:
  <cache usage="read-write">
- ★ Sowohl auf Klassen als auch auf Collection Level
- ★ Volles Caching: Klasse + Collection!

Beispiel

```
@Entity
@Cache(usage=CacheConcurrencyStrategy.NONSTRICT_READ_WRITE)
public class Author implements Serializable {
...
   @Override
   public int hashCode() { ... }
   @Override
   public boolean equals(Object obj) { ... }
}

@Entity
@Cache(usage=CacheConcurrencyStrategy.READ_WRITE)
public class RecordReview implements Article {
...
    @OneToMany(fetch=FetchType.LAZY)
    @Cache(usage=CacheConcurrencyStrategy.NONSTRICT_READ_WRITE)
    private Set<Author> authors = new HashSet<Author>();
...
}
```

Cache Regions

- ★ Einteilung in Cache Regions mit Naming Convention
- ★ Cache Regions werden in Cache Provider Konfiguration referenziert

Klasse de.allschools.domain.Band	Voll qualifizierter Name de.allschools.domain.Band
Collection de.allschools.domain.Record#bands	Klasse + „.“ + Attribut de.allschools.domain.Record.bands

EhCache Beispiel

ehchache.xml

```
<ehcache>
    <diskStore path="java.io.tmp"/>

    <defaultCache maxElementsInMemory="10000" eternal="true"
        overflowToDisk="true" />

    <cache name="de.allschools.domain.Author"
        maxElementsInMemory="30"
        eternal="false"
        timeToIdleSeconds="900"
        timeToLiveSeconds="1800"
        overflowToDisk="true" />
    <cache name="de.allschools.domain.RecordReview.authors"
        maxElementsInMemory="500"
        eternal="false"
        timeToIdleSeconds="600"
        timeToLiveSeconds="1200"
        overflowToDisk="true" />
      ...
</ehcache>
```

Auswahl von Caching Kandidaten?

KONSERVATIV

★ Wenige Inserts und Updates

★ Viele Lesezugriffe

★ Unkritische Daten

★ Von vielen Sessions benötigt

★ Von vielen Usern benötigt

Stateless Session

- ★ sessionFactory.openStatelessSession()
- ★ Command orientierte API
- ★ Kein Persistenz Kontext
- ★ Kein Caching
- ★ Kein Transaktionales write-behind
- ★ Kein Cascading
- ★ Keine Interceptors und Events

Abfragen

Selektivität

- ★ Nur benötige Daten laden
- ★ Möglichst früh einschränken
- ★ Projection verwenden

```
Query query = getSession().createQuery(
  "select
   new TourCityInfo(t.name, d.timestamp, l)
   from Tour t
     inner join t.tourDates d
       with d.timestamp > :datum
     inner join d.location l
   where l.stadt=:stadt
   order by t.name asc"
);
```

```
"from User u
   where u.name=" + name
```

- SQL Injection
- Performance Killer
- Heimtückisch

IMMER BIND VARIABLEN verwenden

```
Query query =
session.createQuery("from User u where u.name= :name");
q.setString("name", "michael");
```

Query Cache

- ★ Wird selten benötigt
- ★ Nur für bestimmte Queries geeignet
- ★ Wird extra konfiguriert:

```
hibernate.cache.use_query_cache=true
```

- ★ Muss pro Query / Criteria aktiviert werden:

```
query.setCacheable(true);
```


To obtain employment as a software developer in a dynamic computer
Highlights
9 years IT
Friendly
Succe
Flair
Exte
creativity and design
sive Internet and Intranet development experience
Employment History
Software De
loper, Computer Company, February 2001 – present
I am a key me
internet search
applications co
responsible for
projects.
ber in the software team responsible for the development of cu
echnology. I have developed several major products and bes
ring all stages of the software development cycle. Additiona
oject management and customer support on a number of
ng edg
e web
am
profile
Major Accomplishm
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Produced state
Developed severa
techniques
Successfully project
to installation
Delivered bespo
Ported softwar
Developed of
Full develop
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based applications using advan
ons to meet specific customer requirements
ous platforms
intranet
ew company website
nated logo detection
d Artificial Intelligence
ment of a high profile project from design
Software Engin
ducation
ostgraduate College 1991
stitute of Technology
2.1 BA (Hons) in Software Engineerir
Jobsville University
2 S levels grade I and II, 1987
5 A Levels grade A, 1987
Jobsville High School
References
John Doe
Chief Technical Officer
Software Company
Computer House
Jobsville
01234 123456
essfully compl
cessary work placements to
veloping Graduate Training Scheme, and
neering Project Team.

Analyse

Logging

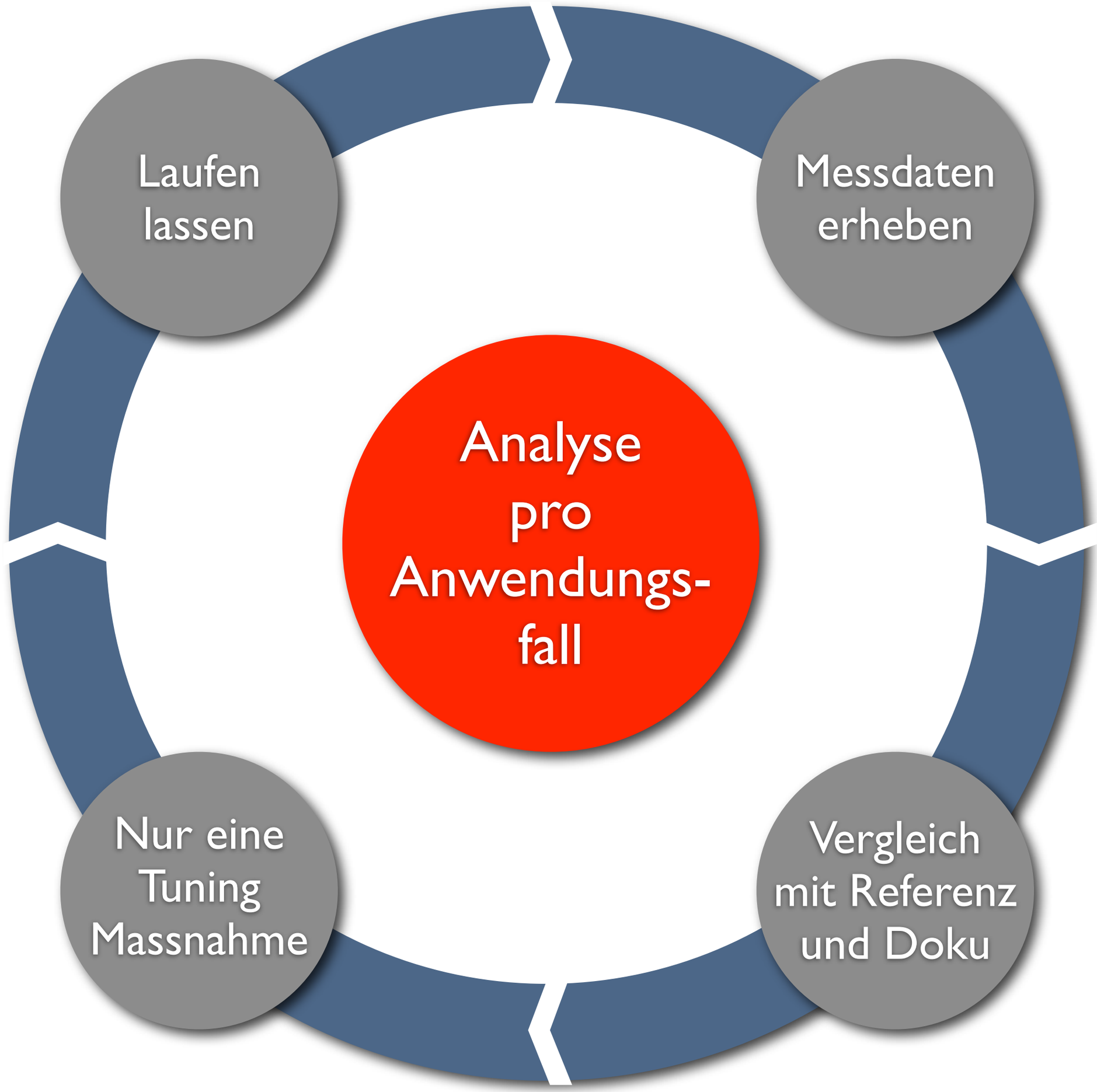
- ★ Sehr detailliert, viele Informationen
- ★ Interessant sind für Tuning:
  - ➡ org.hibernate.jdbc - TRACE
  - ➡ org.hibernate.SQL - TRACE
- ★ Logging auch in User Types integrieren
- ★ Sicht auf plain SQL

Statistics

- ★ Extrem wertvolle Informationen
- ★ Müssen extra aktiviert werden
  - ➡ Konfiguration: hibernate.generate_statistics
  - ➡ Programmatisch: sessionFactory.getStatistics().setStatisticsEnabled(true)
- ★ Zugriff
  - ➡ Programmatisch: sessionFactory.getStatistics()
  - ➡ JMX

Datenbank + Infrastruktur

- ★ Auch in der Datenbank analysieren
  - ➡ Sind alle Indizes korrekt gesetzt?
  - ➡ Wie ist das Laufzeitverhalten?
- ★ Gleiches gilt für Infrastruktur
  - ➡ Connection Pool
  - ➡ Transaktions Monitor
  - ➡ Applikations Server


Laufen lassen
Messdaten erheben
Analyse pro Anwendungs-fall
Nur eine Tuning Massnahme
Vergleich mit Referenz und Doku

Lasttest

- ★ Arten
  - ➡ Normale Last
  - ➡ Stresstest
  - ➡ Lange Lauzeiten
- ★ Setup:
  - ➡ Realistisches Hardware Sizing
  - ➡ Realistische Datenmenge

VIELEN DANK!

FRAGEN?

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