



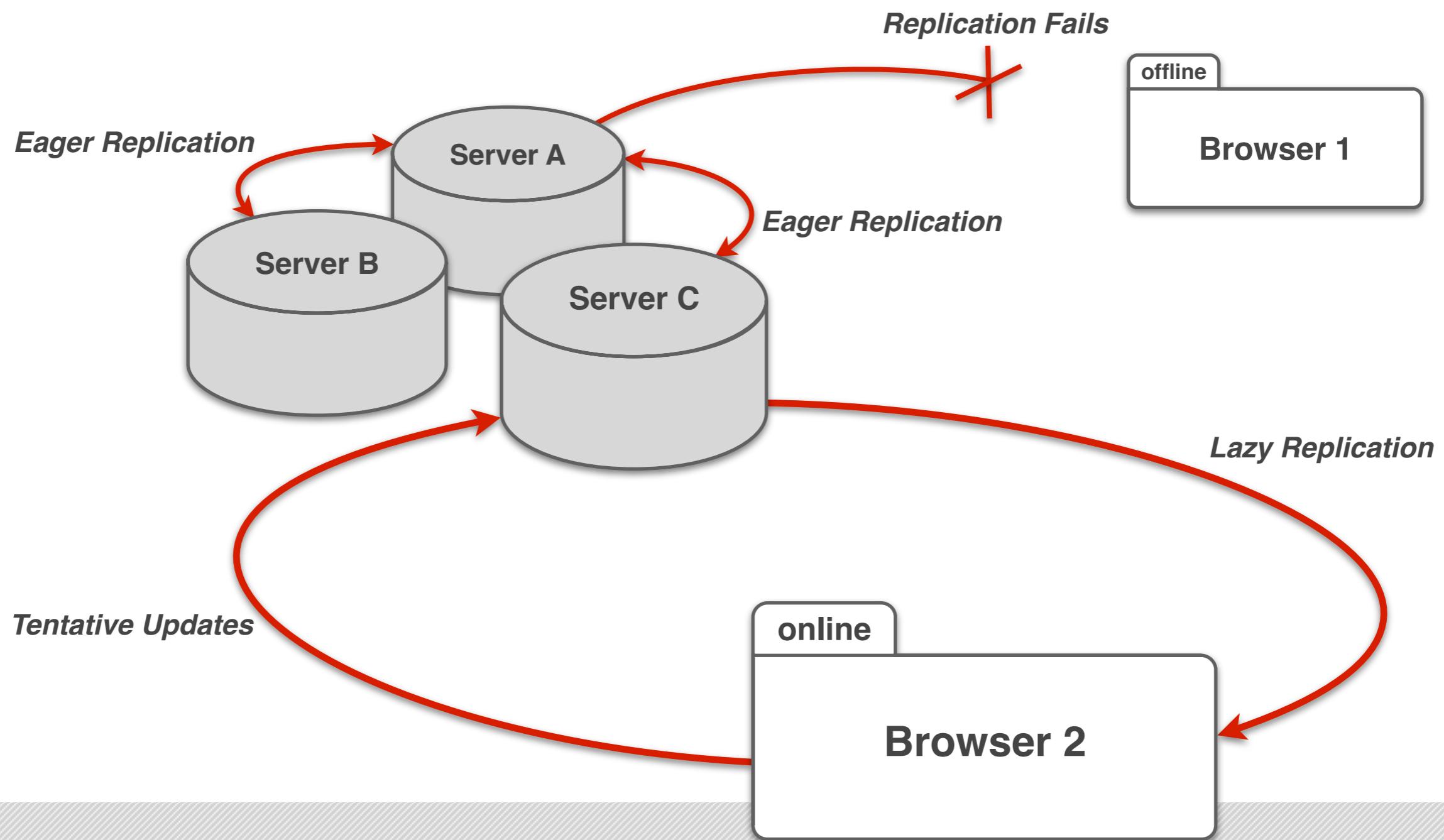
Data Replication for Offline Web Applications

Optimizing Synchronization, Persistence and Conflict Resolution

- › Master Thesis Samuel Esposito
- › Supervisors: Prof.dr. M. Aiello, MSc A.C. Emerencia
- › Second reader: Prof. dr. ir. P. Avgeriou

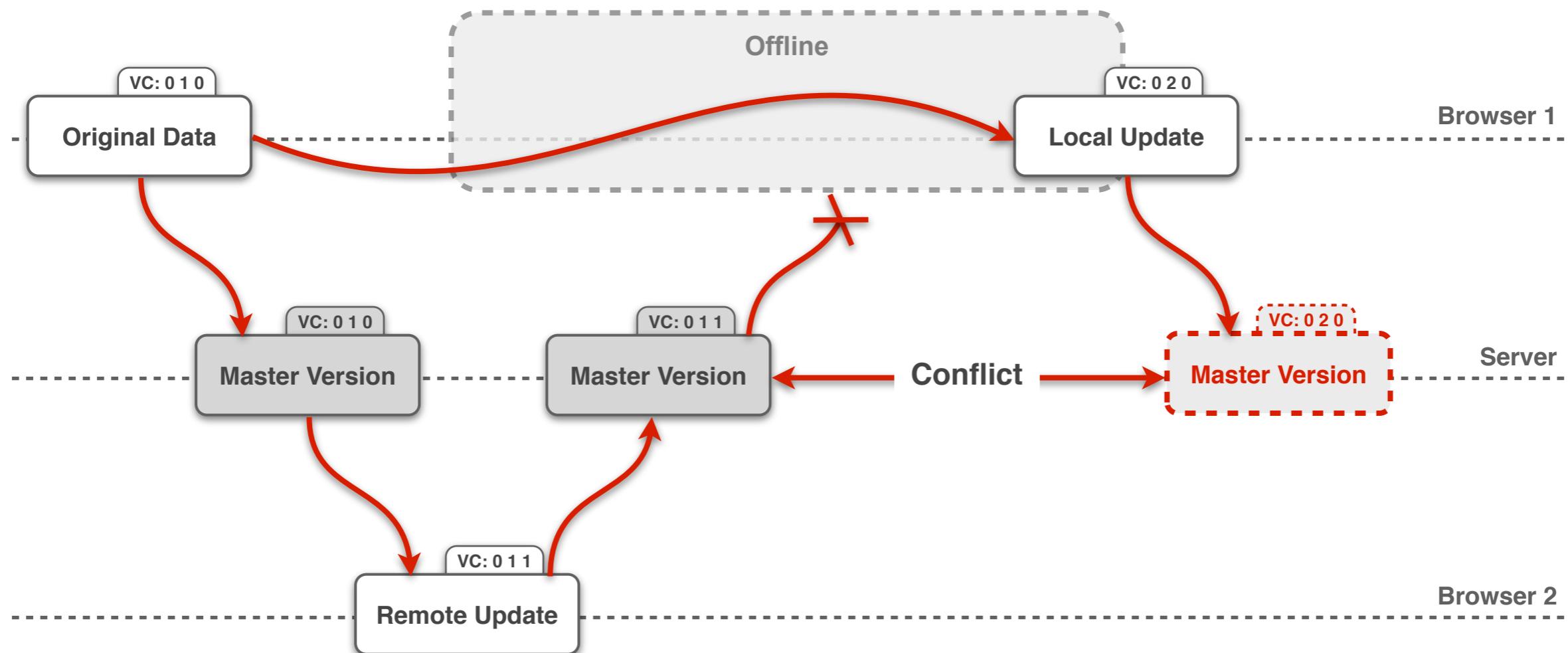


Two-tier architecture



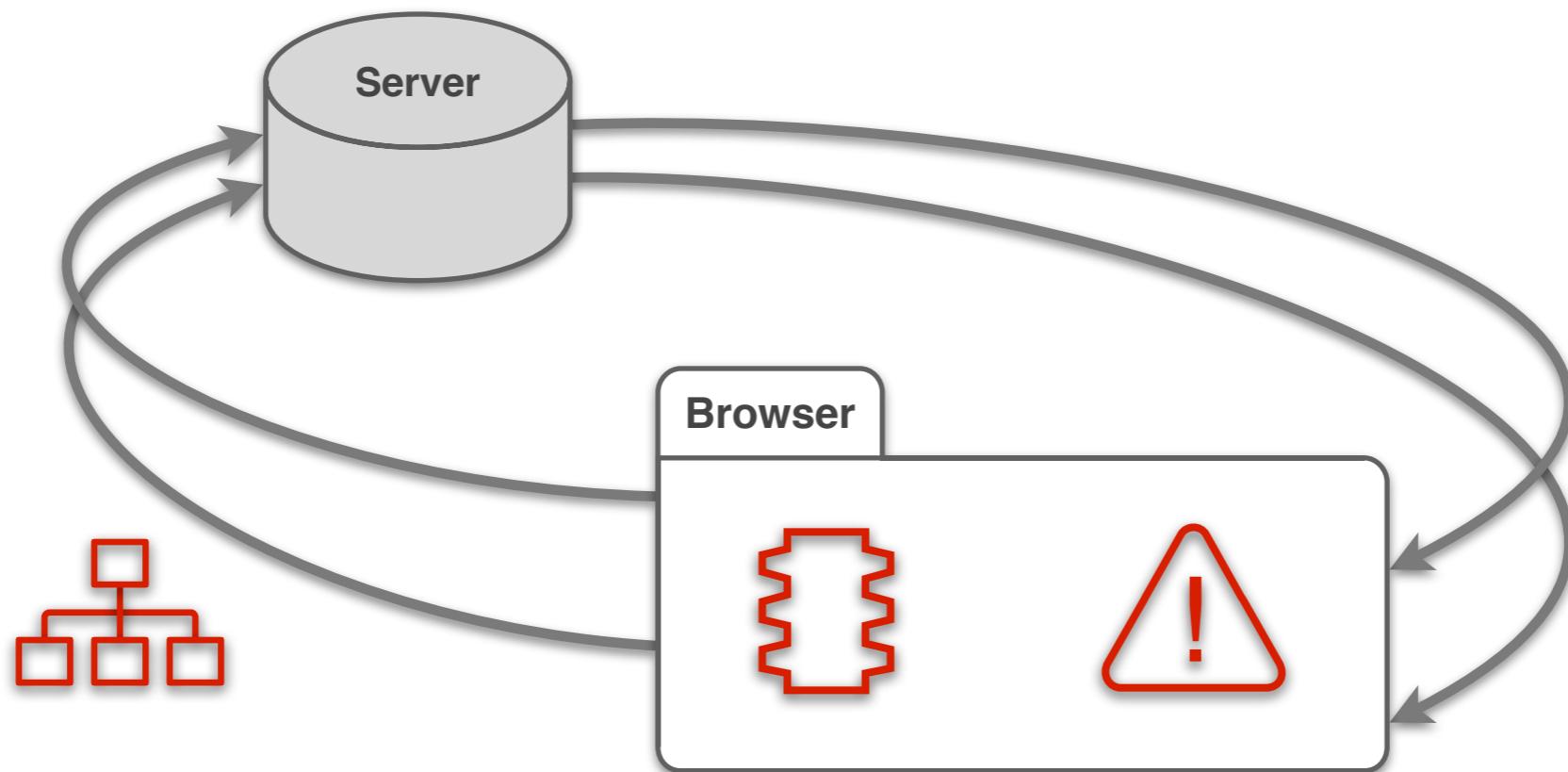


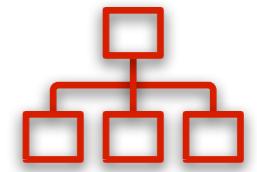
On the origin of conflicts



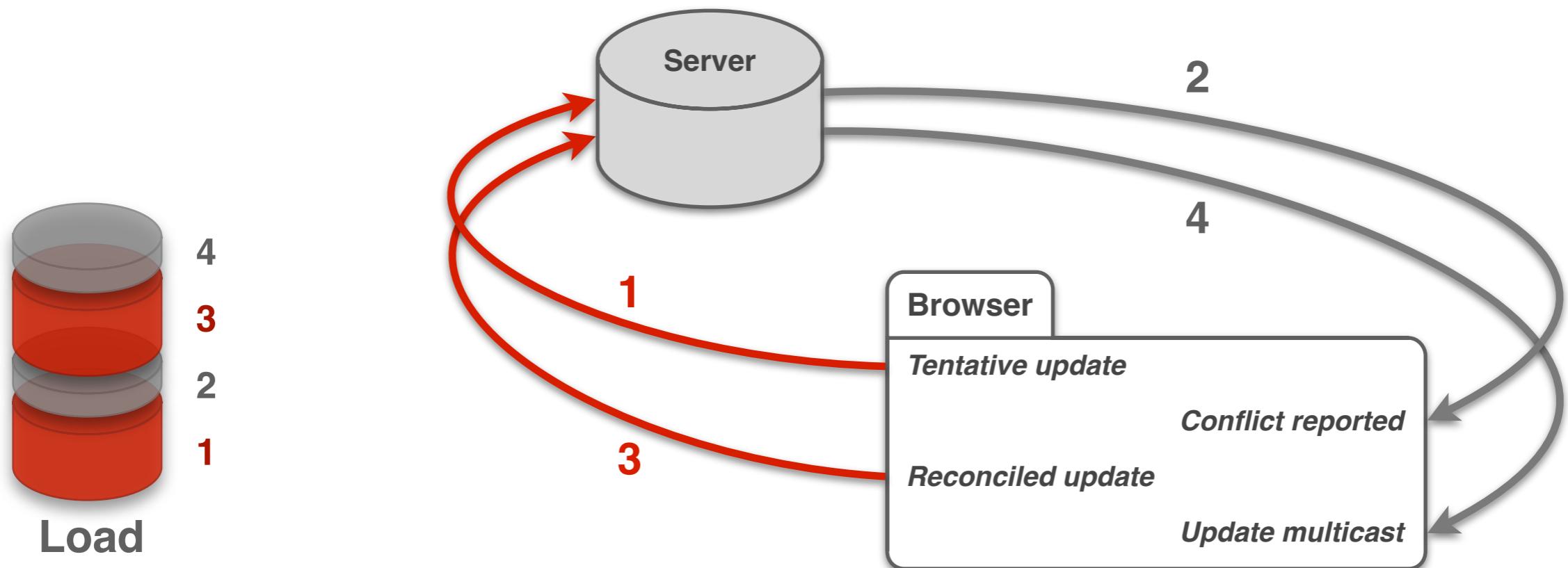


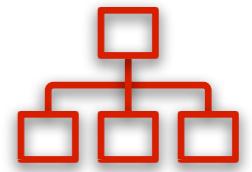
Optimizations



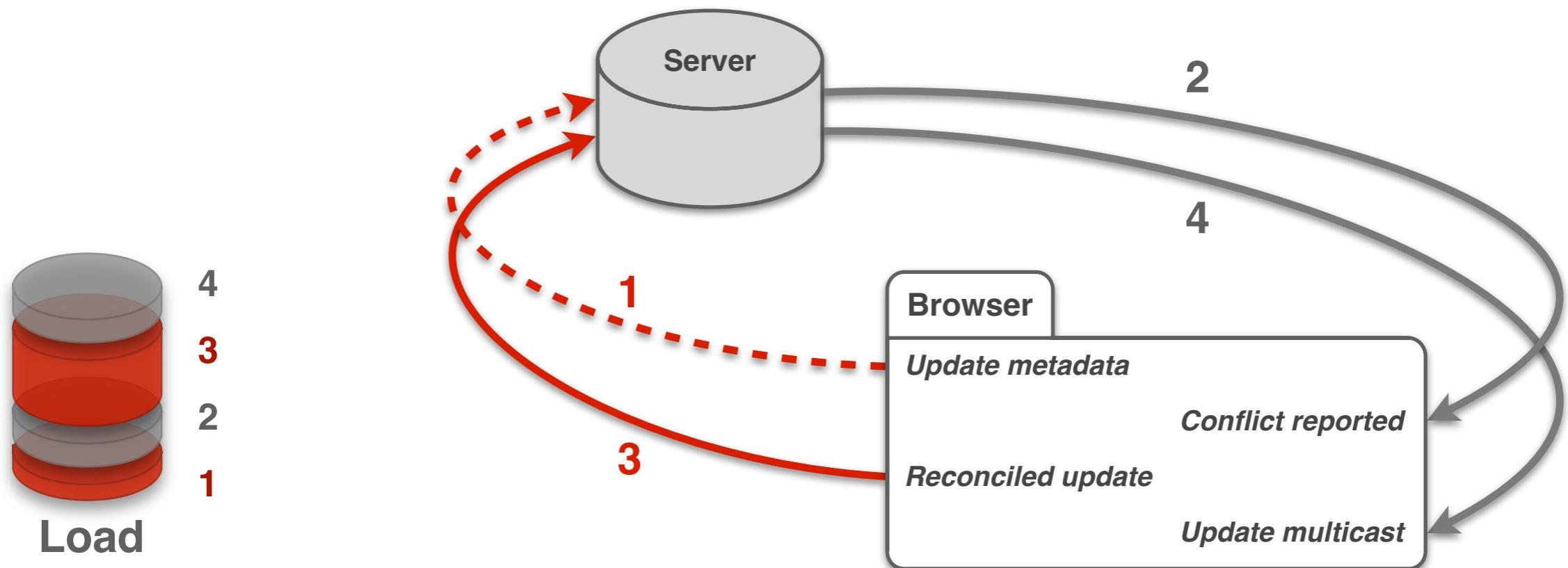


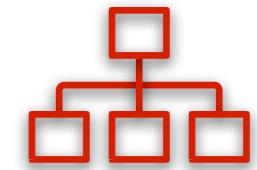
Network load: traditional synchronization



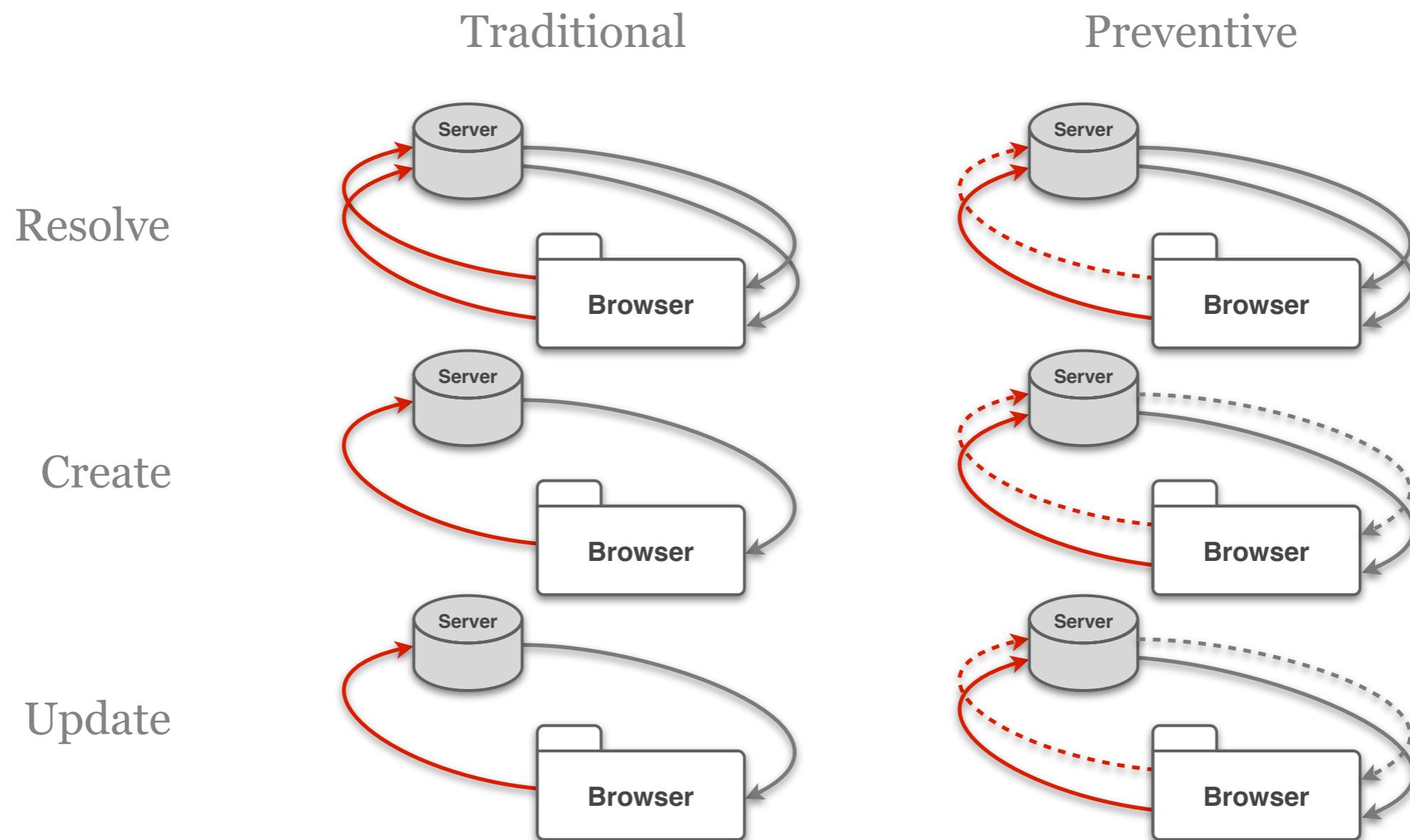


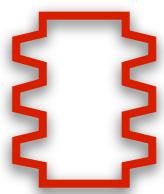
Network load: preventive reconciliation



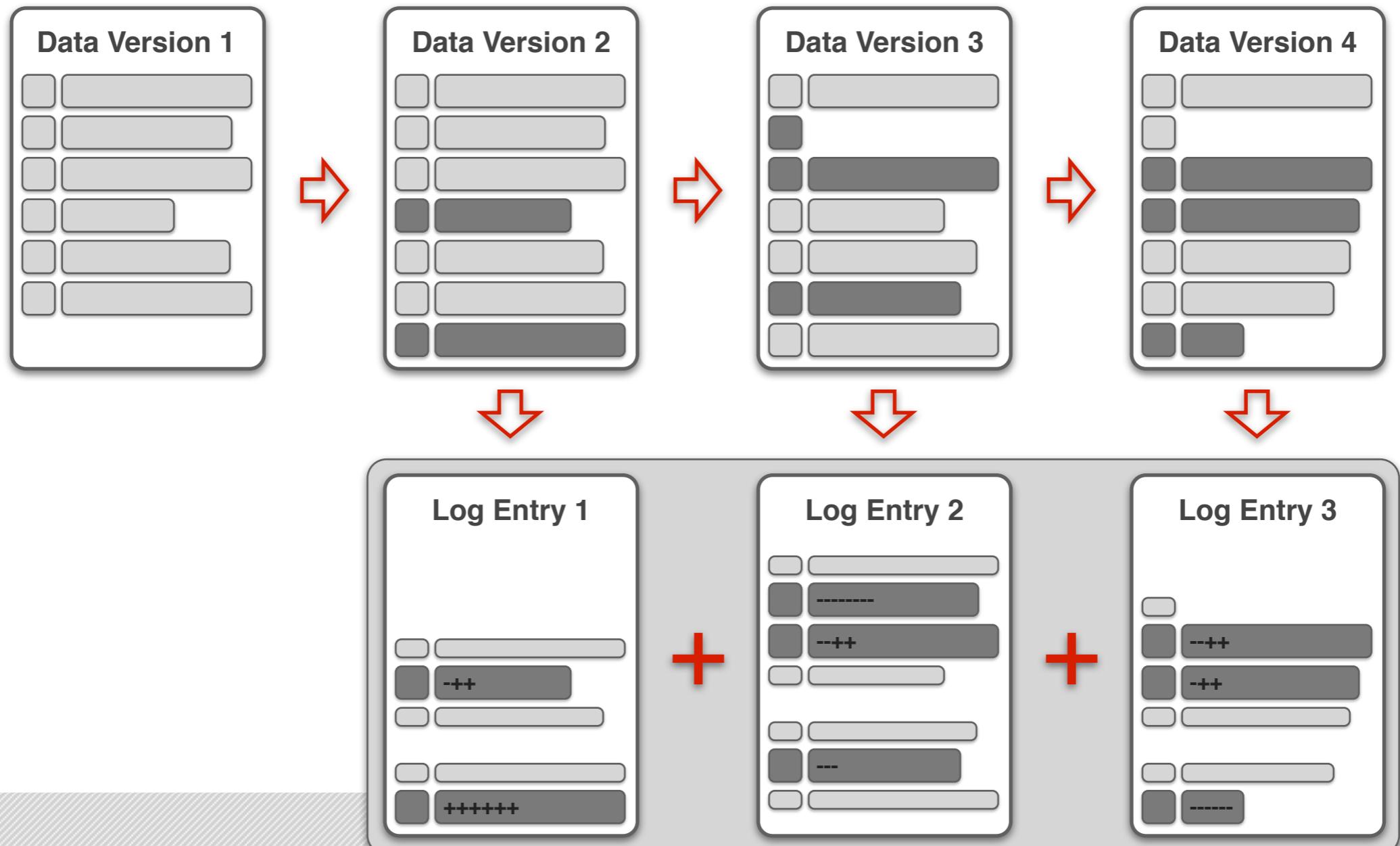


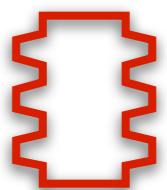
Network load: preventive reconciliation



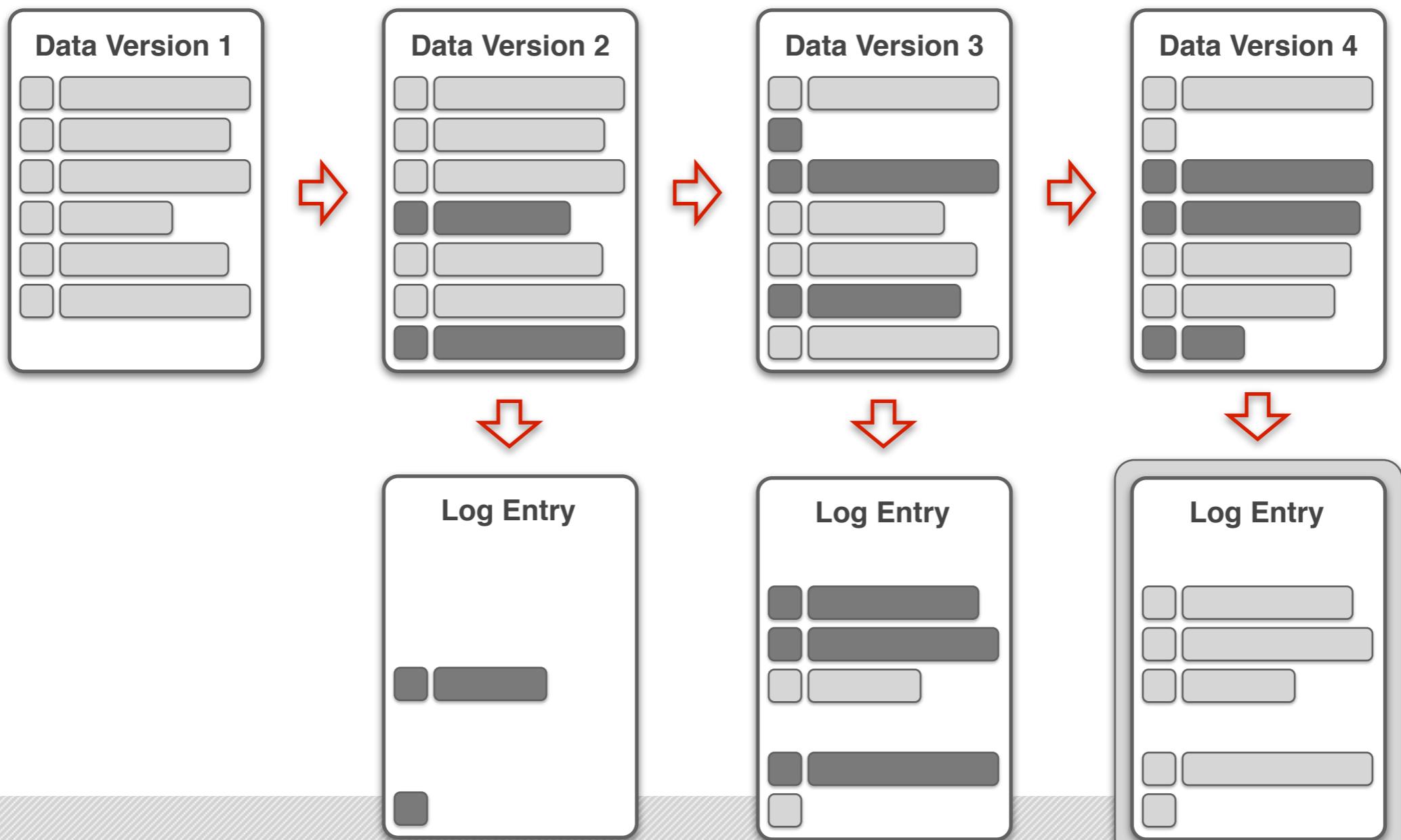


Memory footprint: incremental browser log



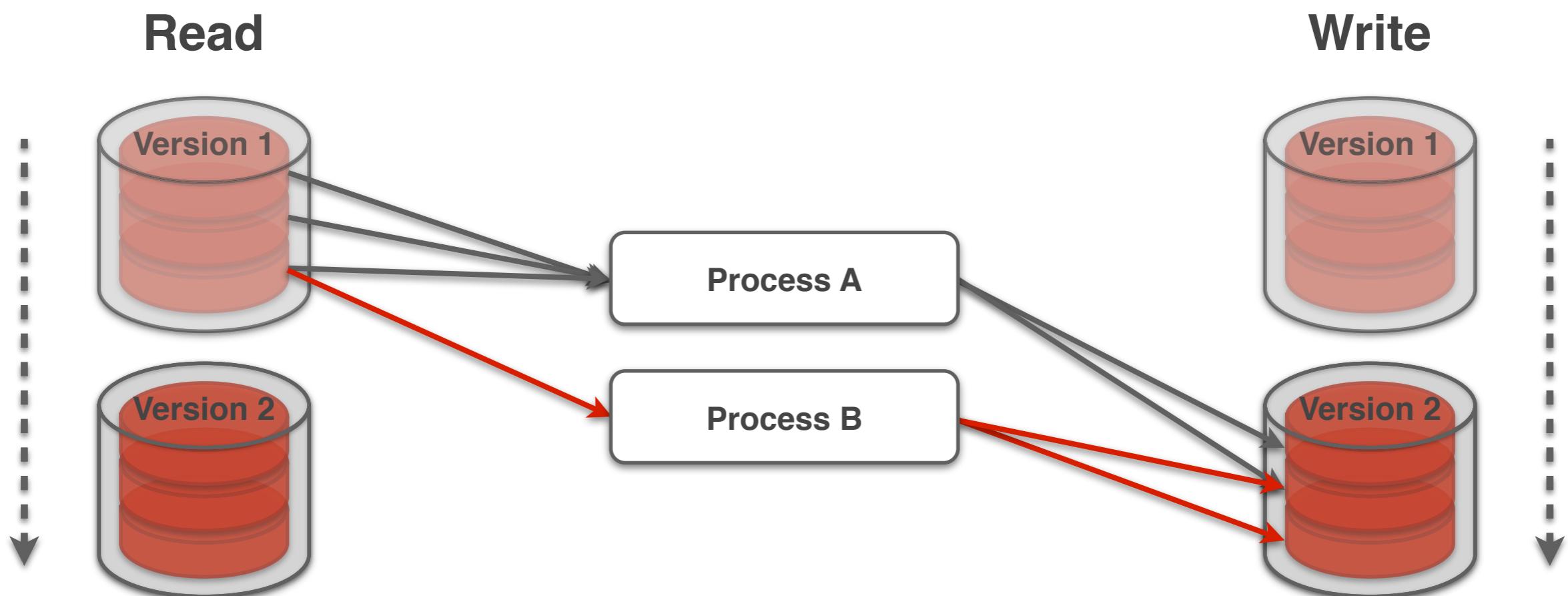


Memory footprint: merged browser log



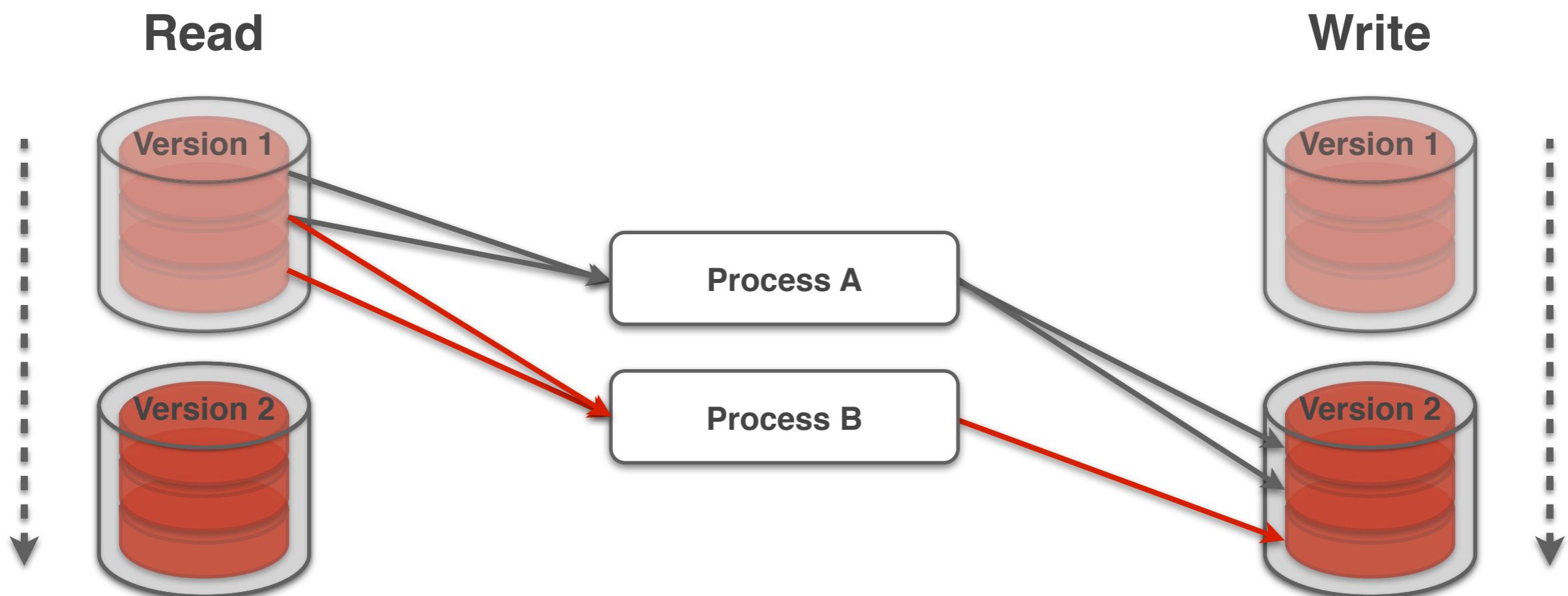


Automated conflict resolution



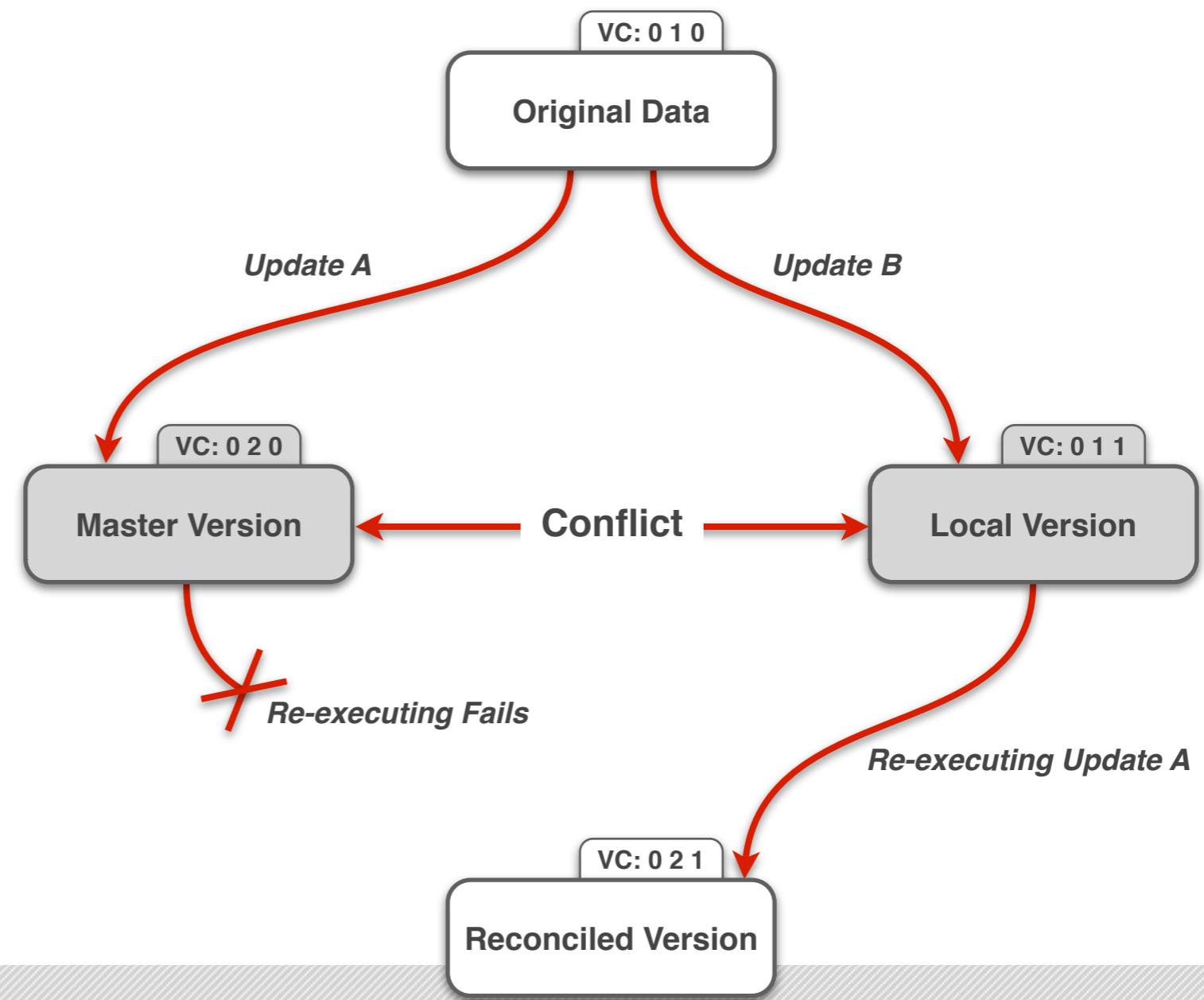
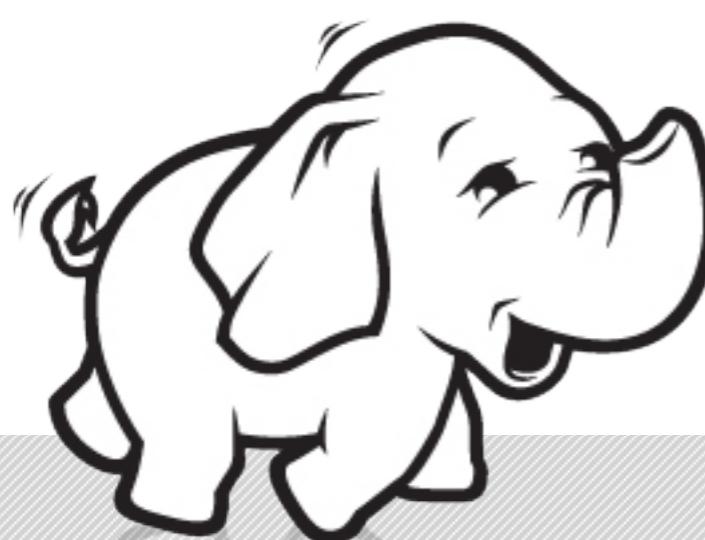


Automated conflict resolution



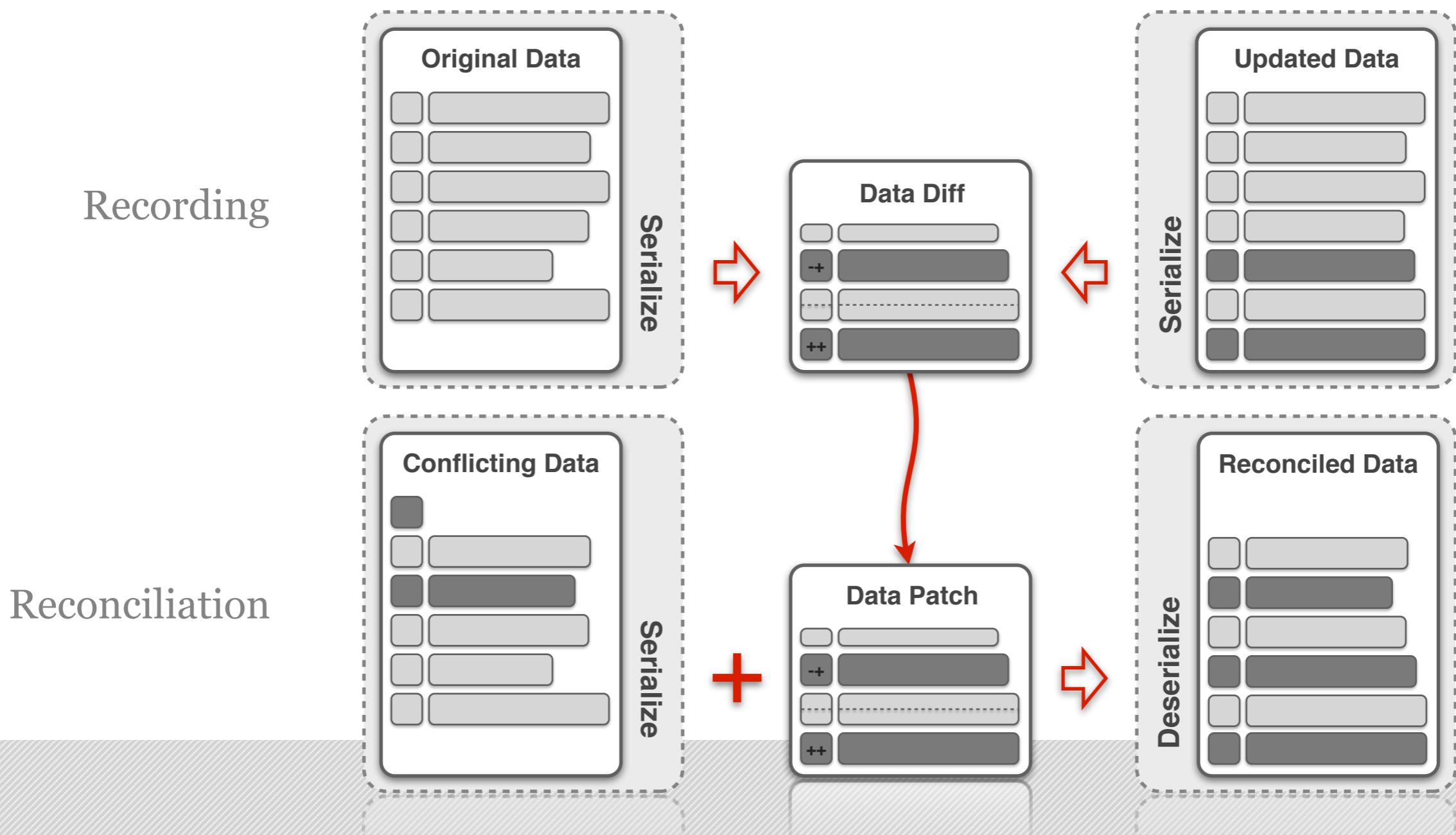


Eager conflict resolution





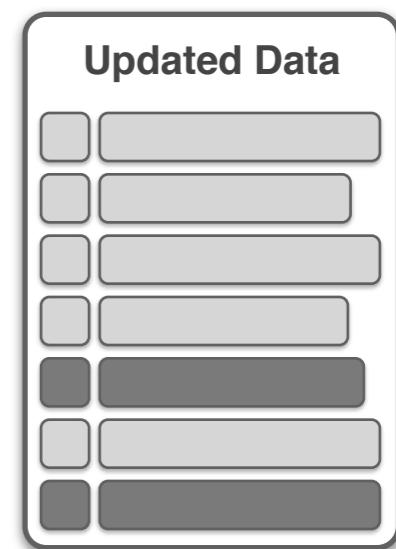
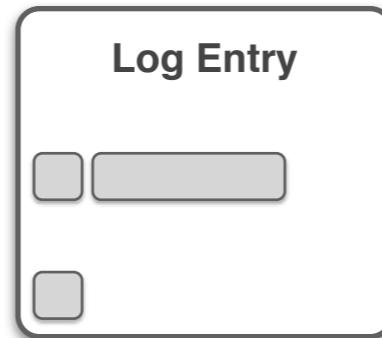
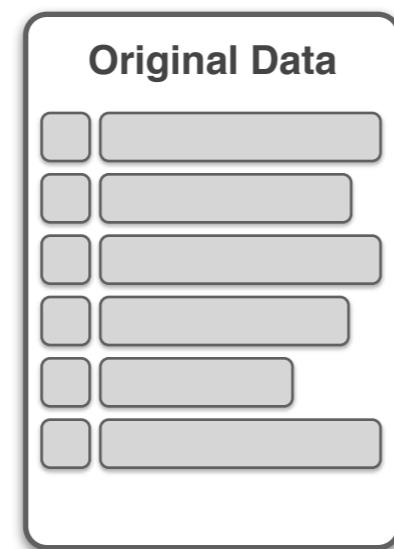
Eager conflict resolution: serialized data





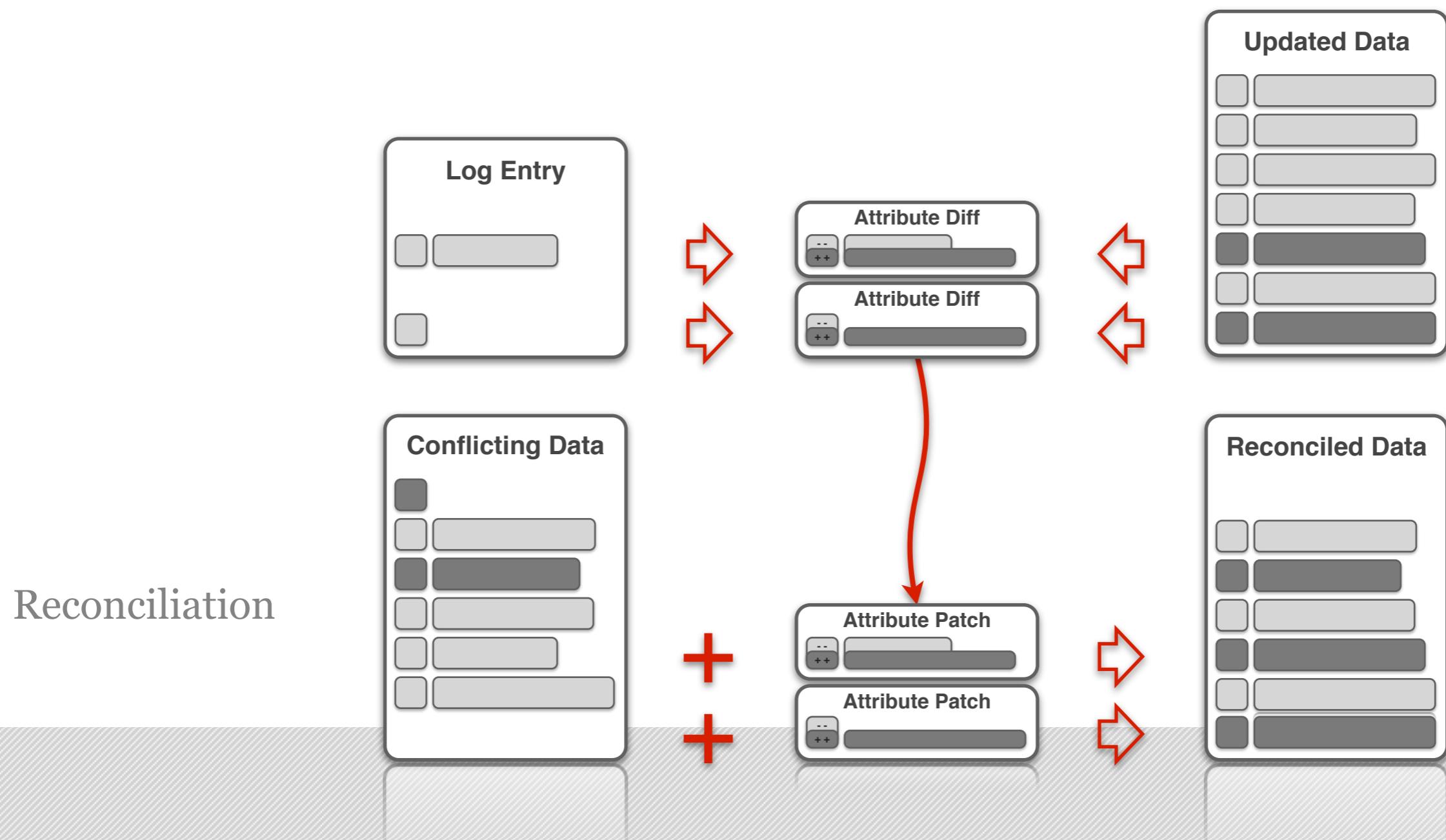
Eager conflict resolution: attribute oriented

Recording



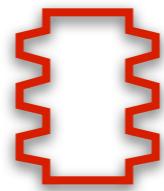
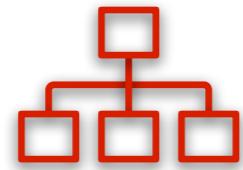


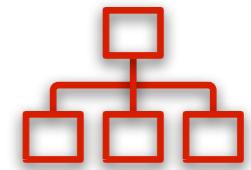
Eager conflict resolution: attribute oriented





Results

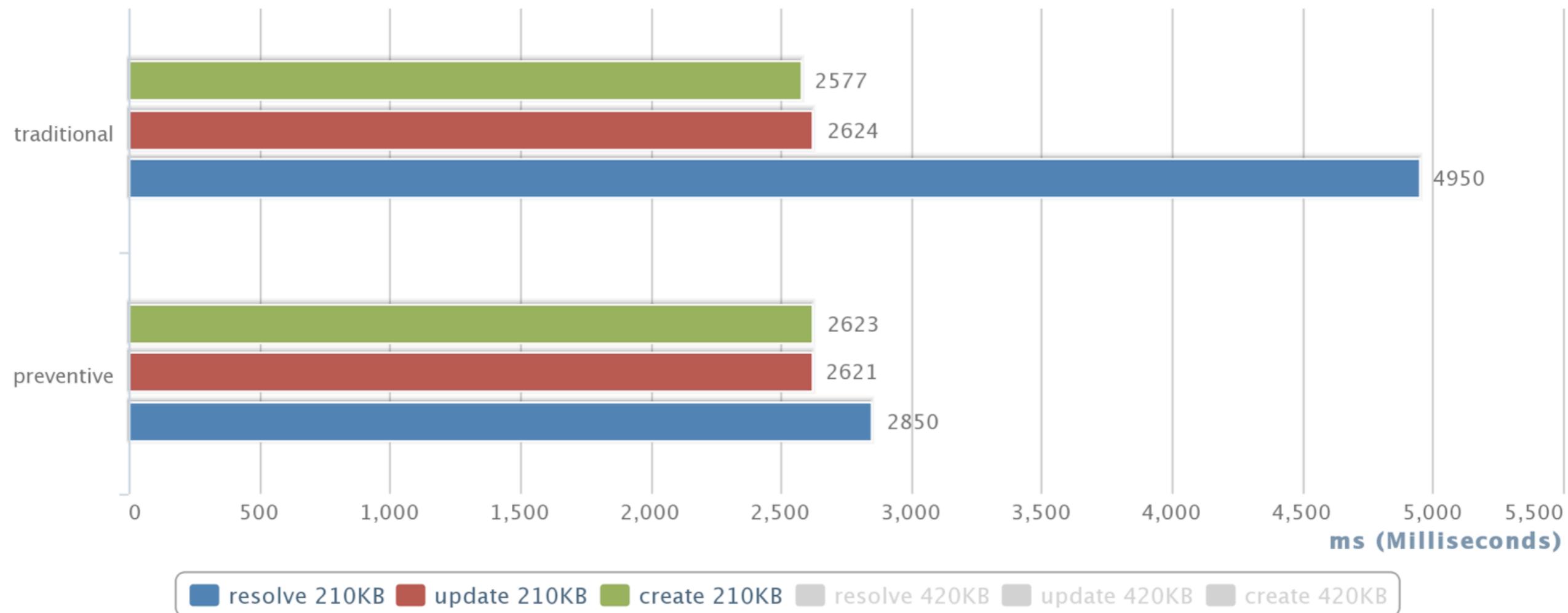


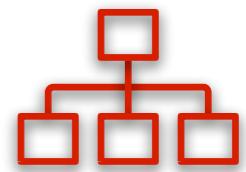


30-05-2013 |

Traditional Synchronization vs. Preventive Reconciliation

Network load during different synchronization operations [Final Mean]

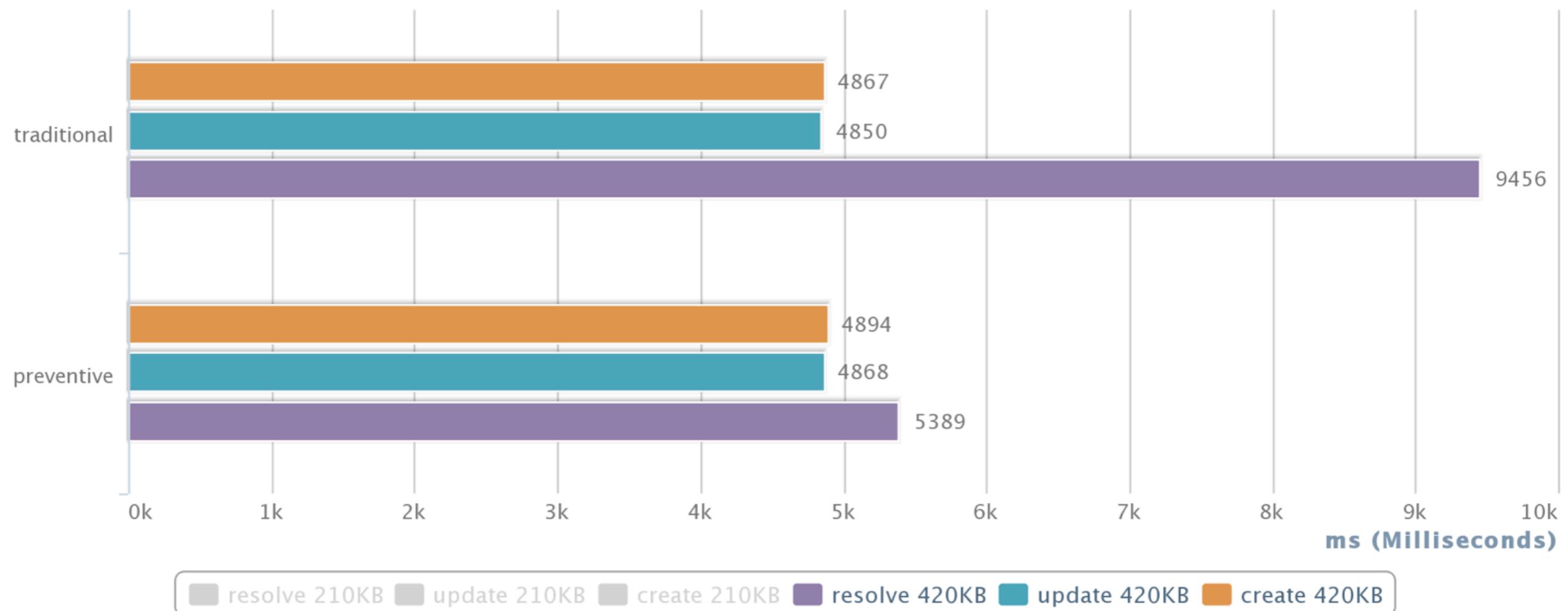


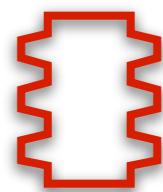


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Traditional Synchronization vs. Preventive Reconciliation

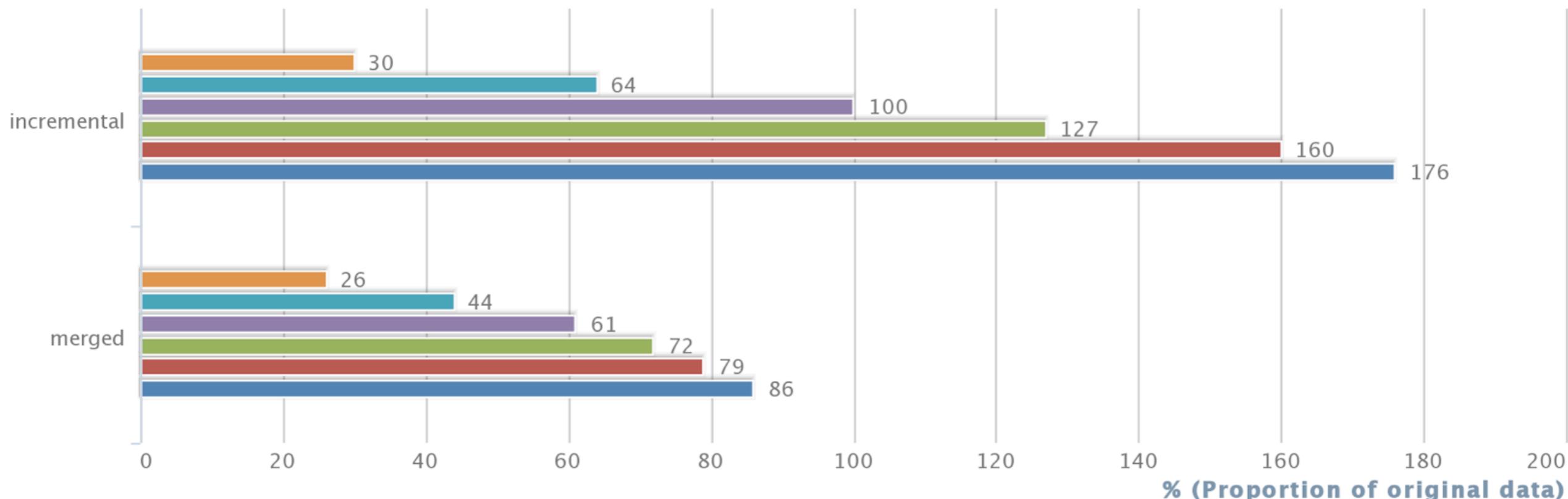
Network load during different synchronization operations [Final Mean]



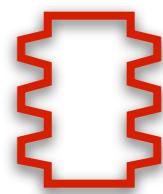


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Incremental vs. Merged Browser Log
Memory footprint for recording local updates [Final Mean]

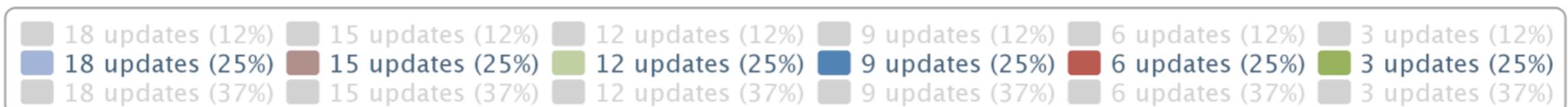
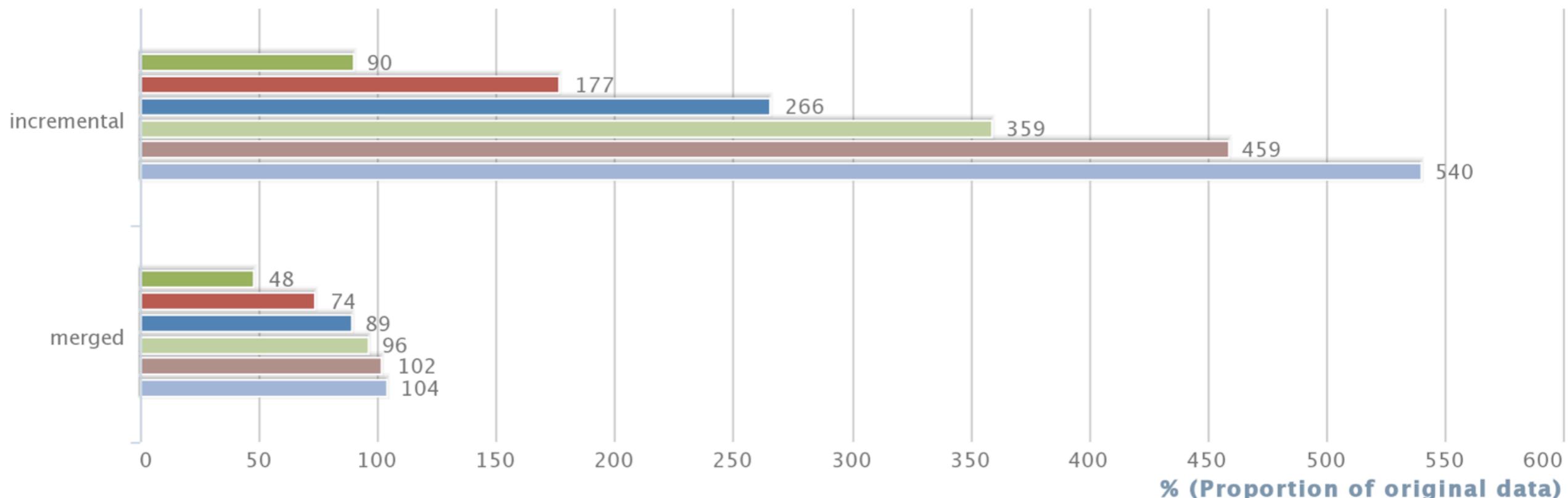


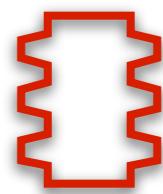
- | | | | | | |
|------------------|------------------|------------------|-----------------|-----------------|-----------------|
| 18 updates (12%) | 15 updates (12%) | 12 updates (12%) | 9 updates (12%) | 6 updates (12%) | 3 updates (12%) |
| 18 updates (25%) | 15 updates (25%) | 12 updates (25%) | 9 updates (25%) | 6 updates (25%) | 3 updates (25%) |
| 18 updates (37%) | 15 updates (37%) | 12 updates (37%) | 9 updates (37%) | 6 updates (37%) | 3 updates (37%) |



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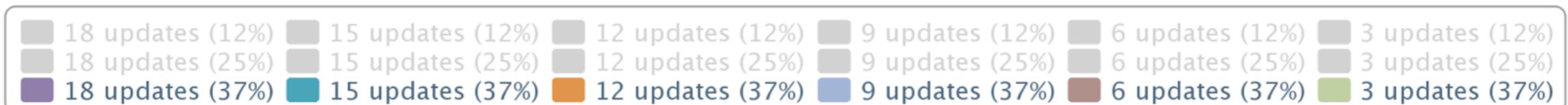
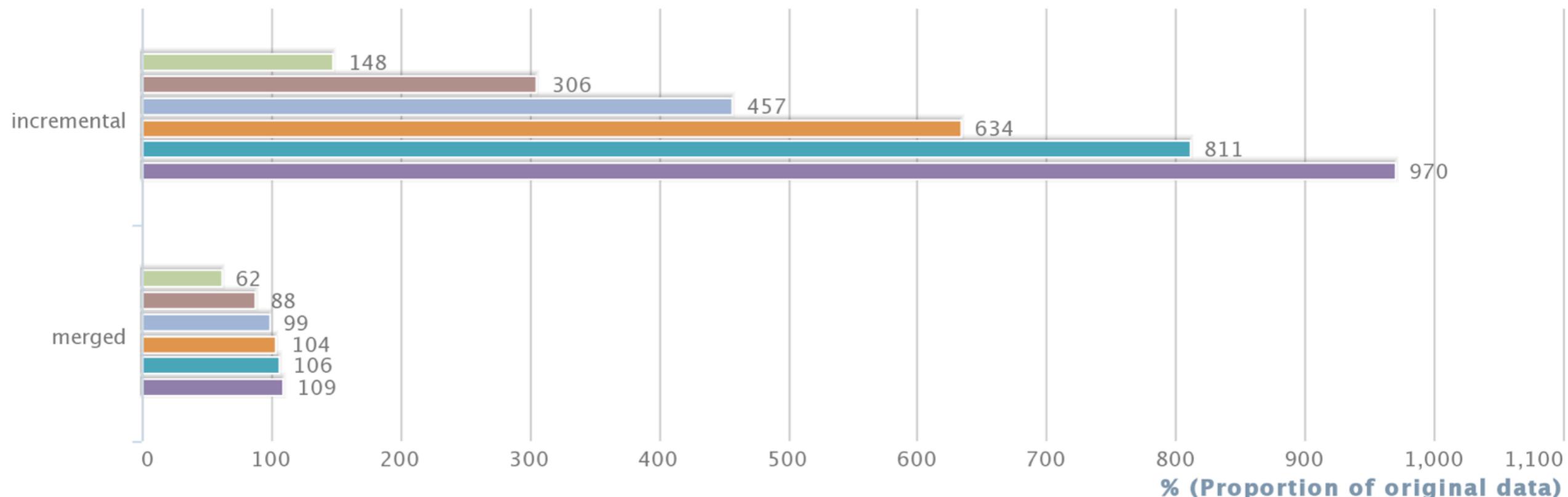
Incremental vs. Merged Browser Log
Memory footprint for recording local updates [Final Mean]





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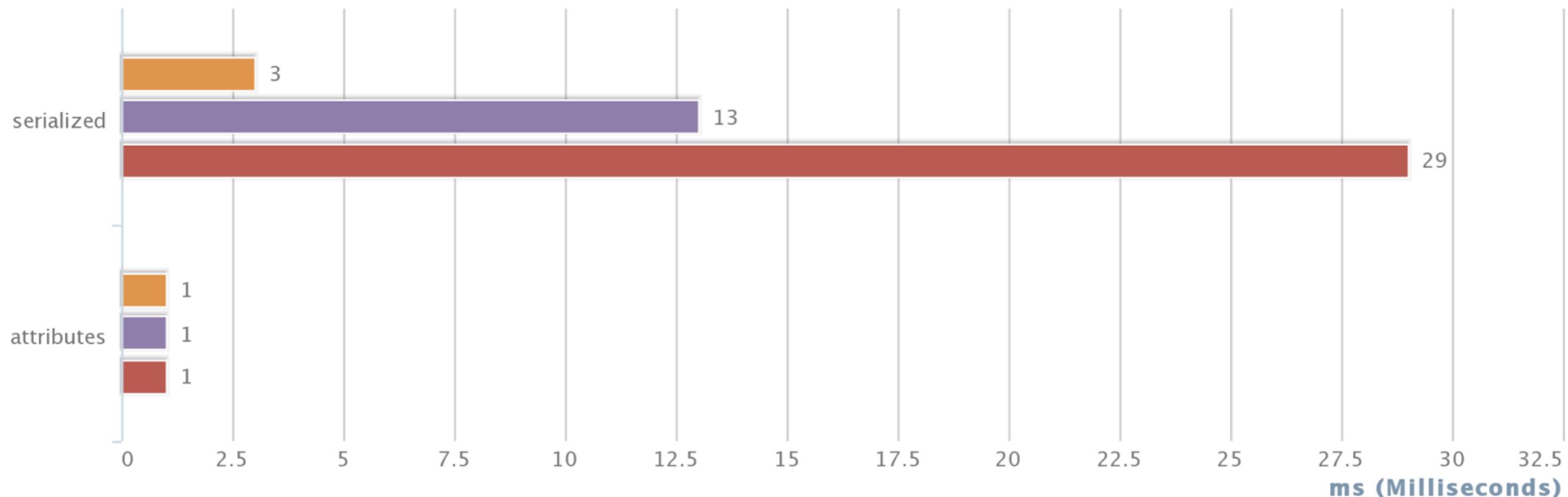
Incremental vs. Merged Browser Log
Memory footprint for recording local updates [Final Mean]





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Serialized Data vs. Attribute Oriented Approach
Performance overhead of recording updates and resolving conflicts [Final Mean]

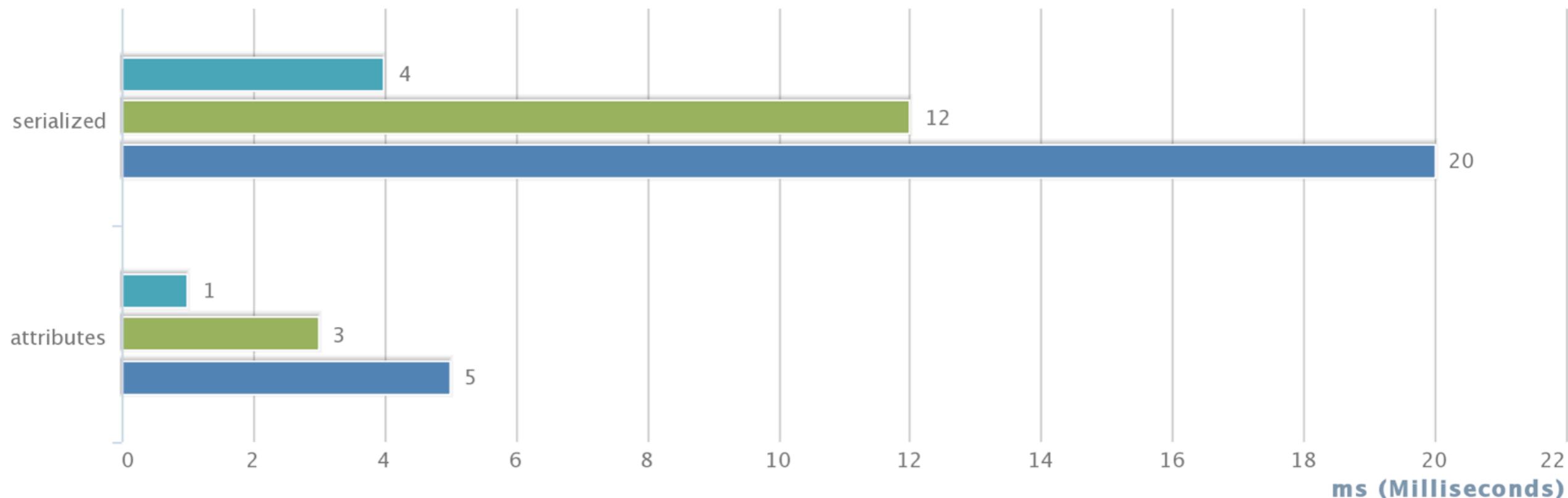


Legend:
resolve(37%) record(37%) resolve(25%) record(25%) resolve(12%) record(12%)
resolve 37% (strings & mods only) record 37% (strings & mods only)
resolve 25% (strings & mods only) record 25% (strings & mods only)
resolve 12% (strings & mods only) record 12% (strings & mods only)



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Serialized Data vs. Attribute Oriented Approach
Performance overhead of recording updates and resolving conflicts [Final Mean]



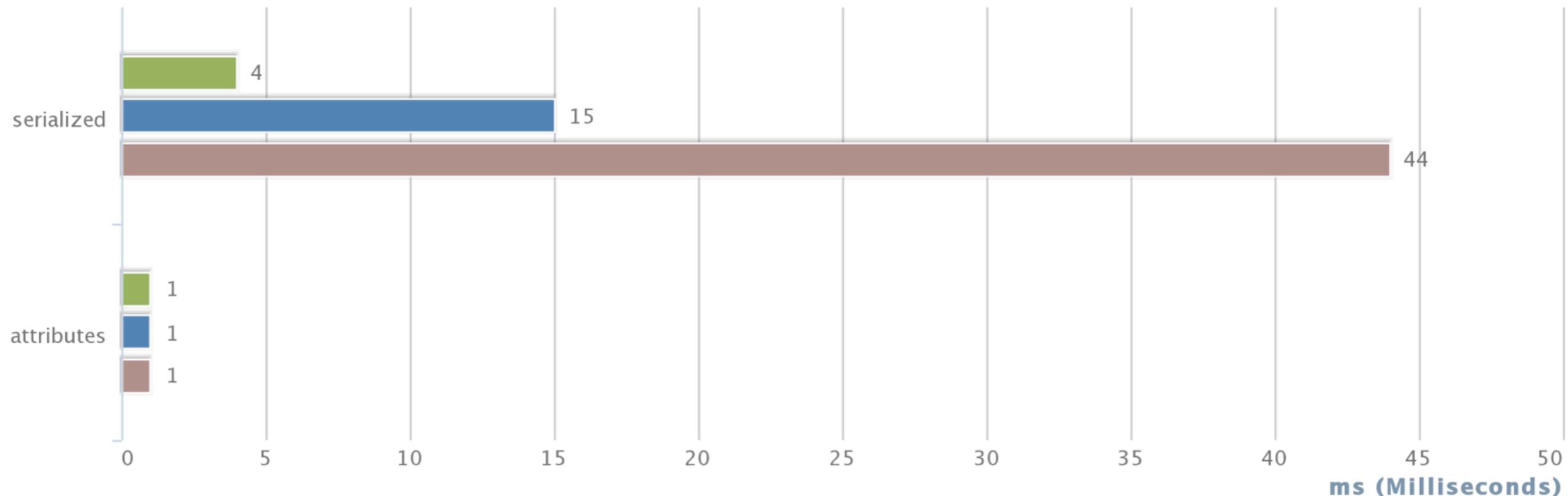
Legend:

- resolve(37%)
- record(37%)
- resolve(25%)
- record(25%)
- resolve(12%)
- record(12%)
- resolve 37% (strings & mods only)
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- record 25% (strings & mods only)
- resolve 12% (strings & mods only)
- record 12% (strings & mods only)



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Serialized Data vs. Attribute Oriented Approach
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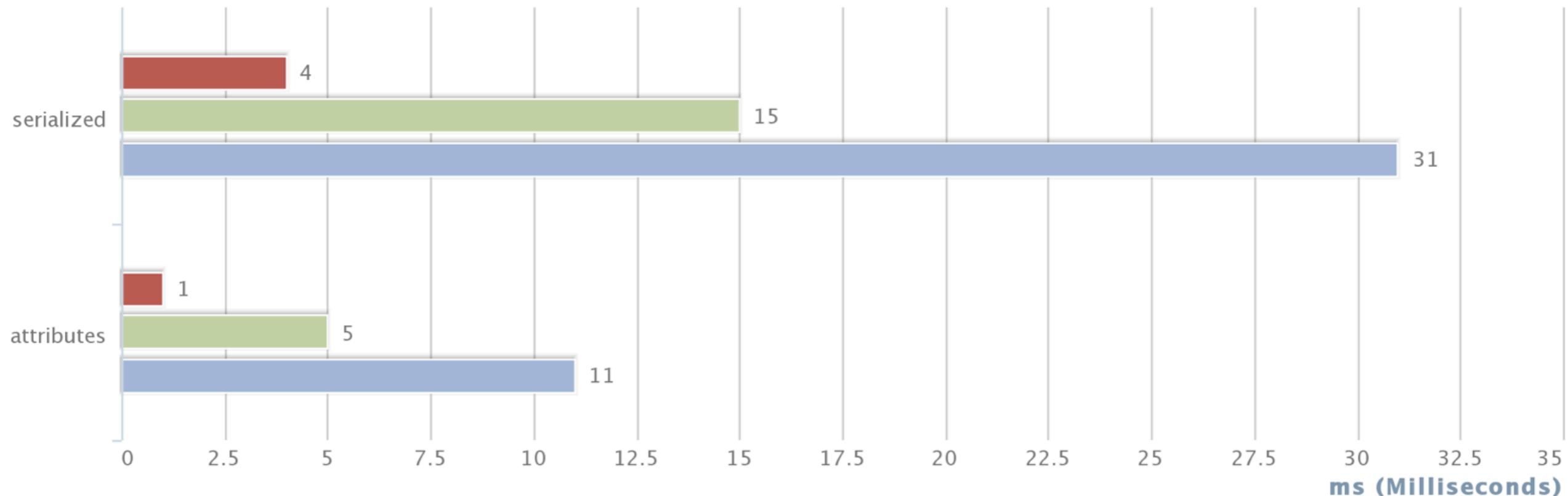
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Serialized Data vs. Attribute Oriented Approach
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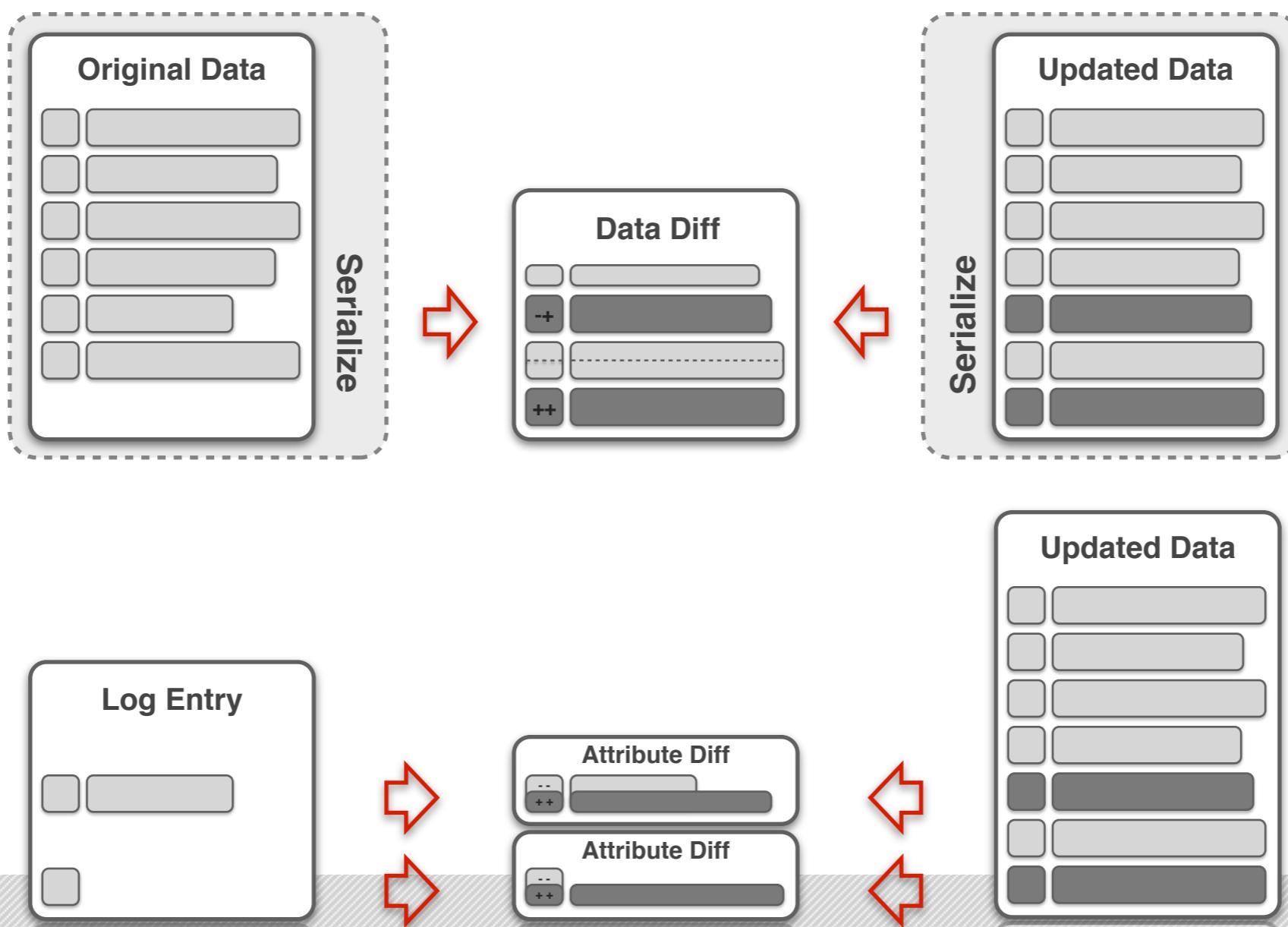


Legend:

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- record 12% (strings & mods only)



Time complexity: $O(N + D^2)$

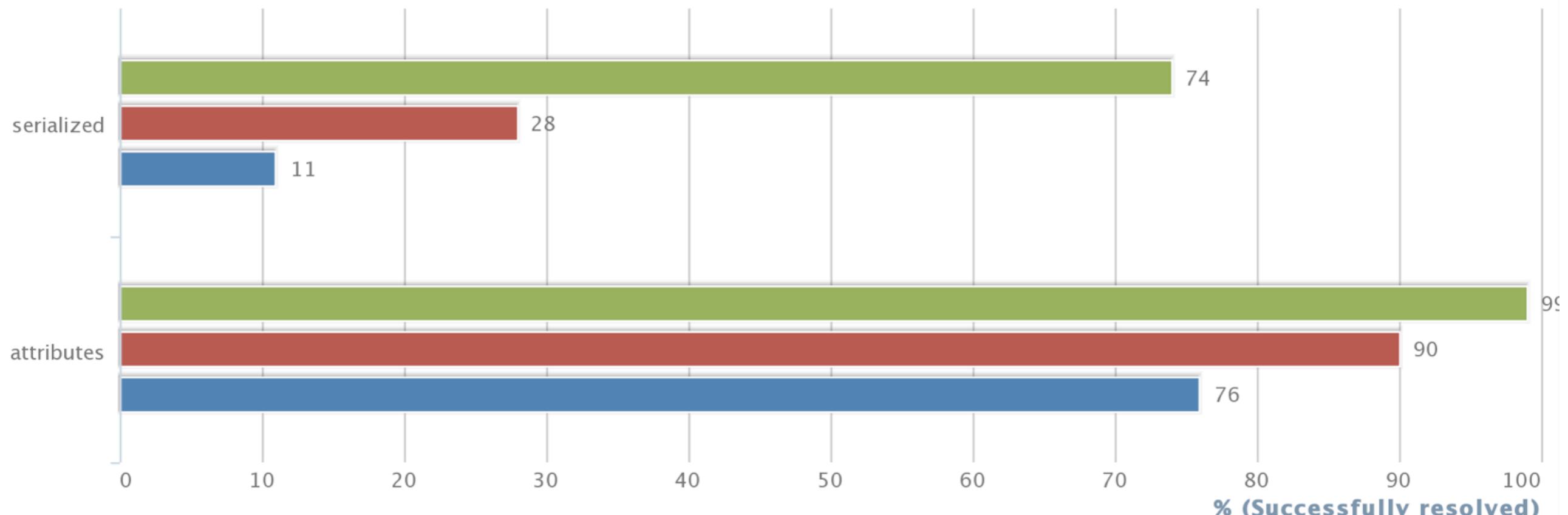




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Serialized Data vs. Attribute Oriented Approach

Proportion successfully resolved conflicts [Final Mean]

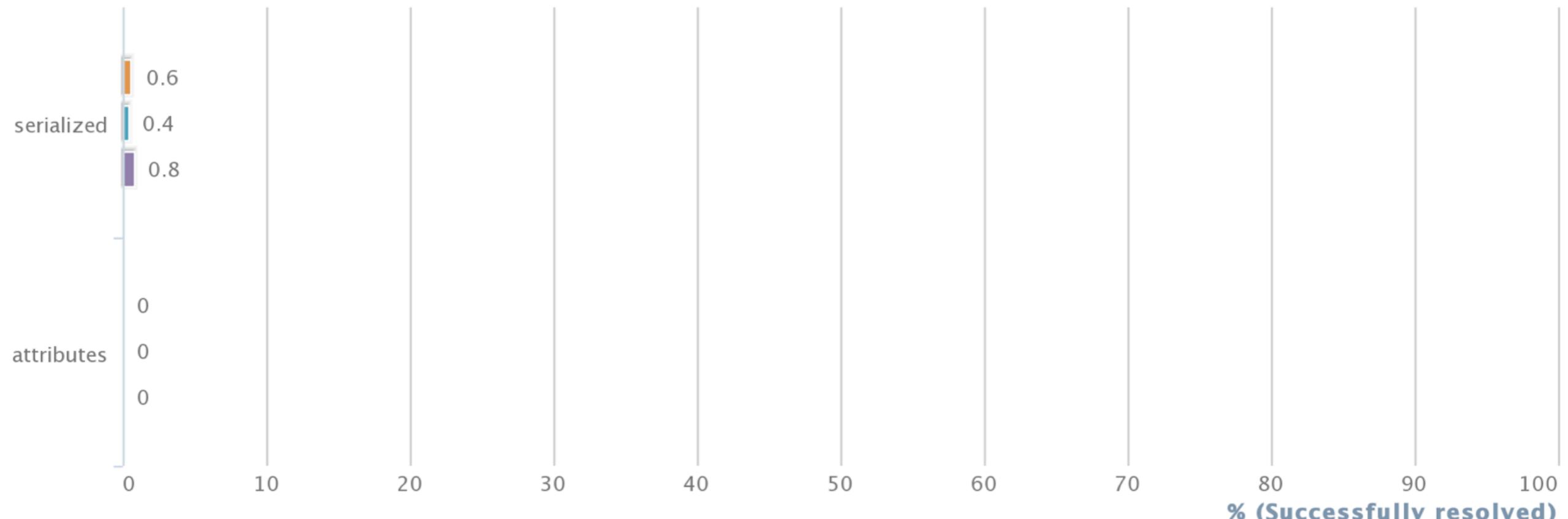


37% 25% 12% 37% (mangled data) 25% (mangled data) 12% (mangled data) 37% (strings only)
25% (strings only) 12% (strings only) 37% (mods only) 25% (mods only) 12% (mods only)



Serialized Data vs. Attribute Oriented Approach

Proportion successfully resolved conflicts [Final Mean]



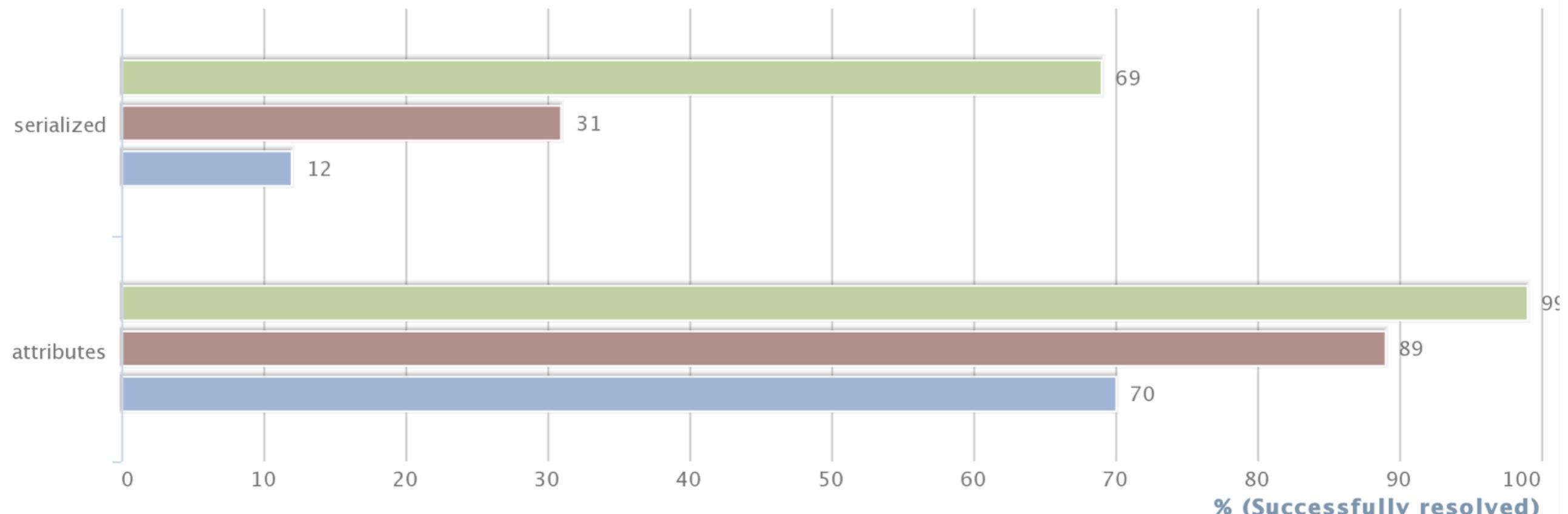
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Serialized Data vs. Attribute Oriented Approach

Proportion successfully resolved conflicts [Final Mean]



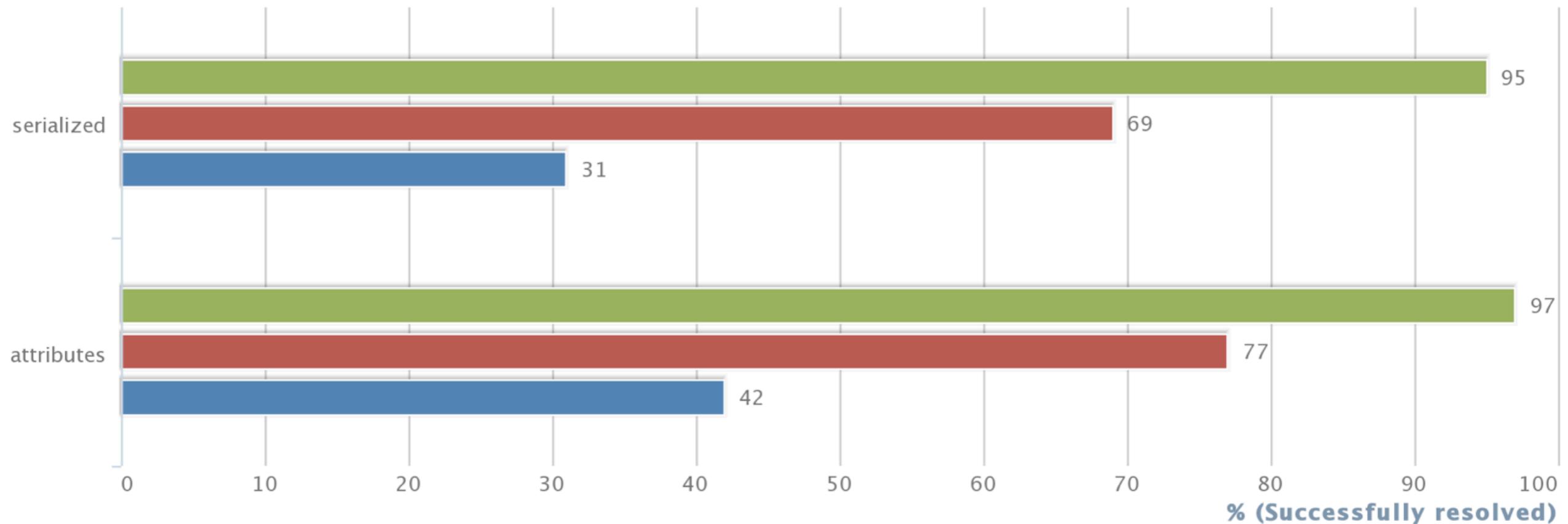
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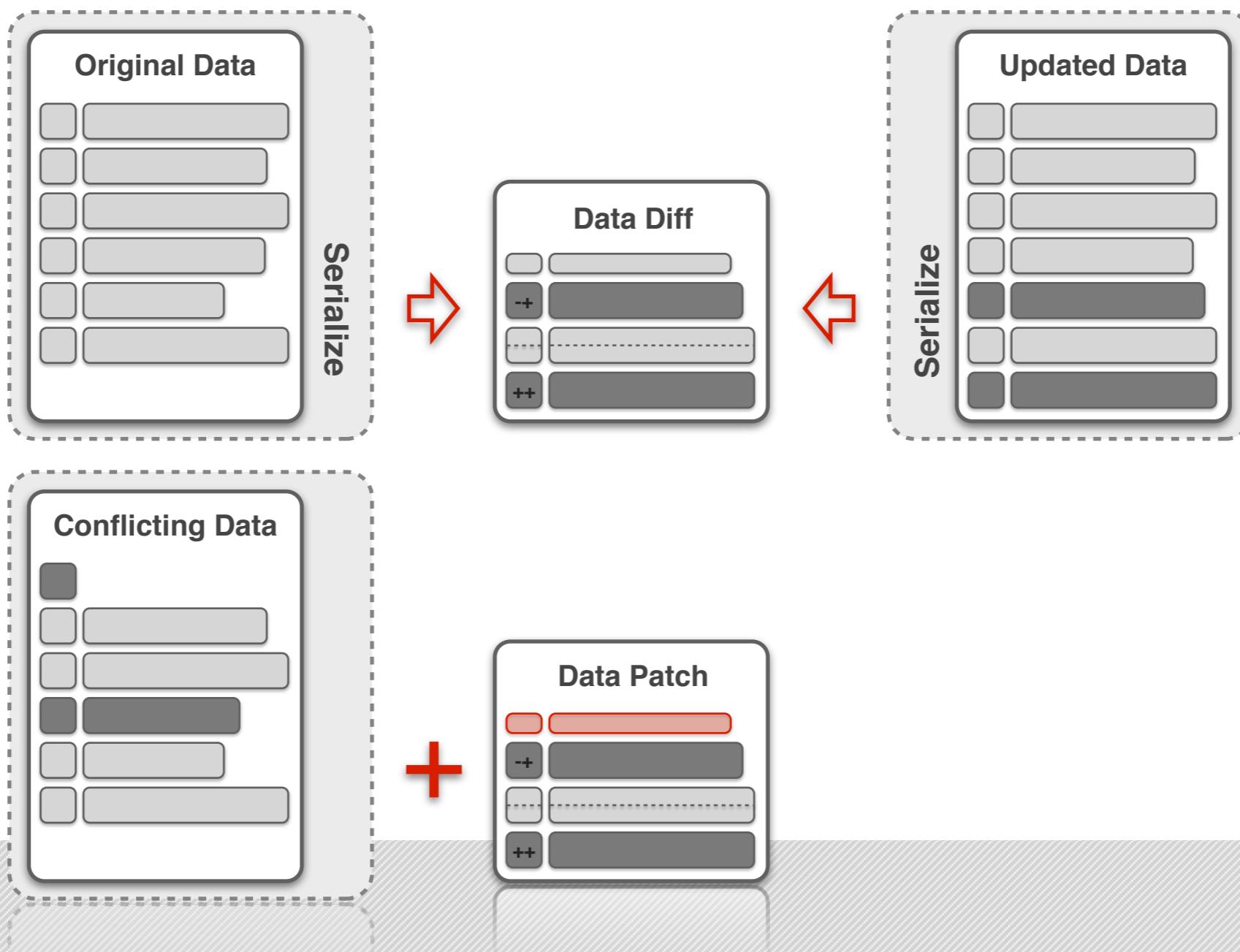
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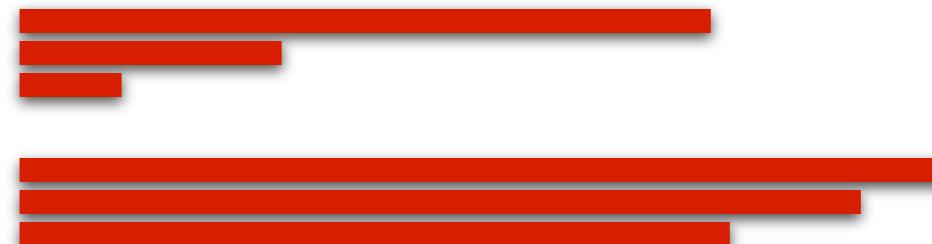
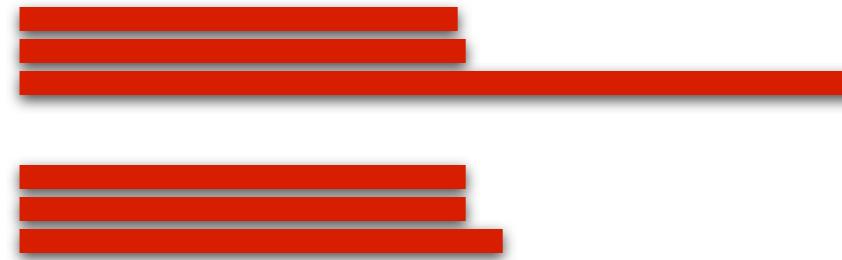
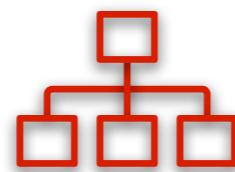


Context mismatches





Conclusion





university of
groningen

faculty of mathematics
and natural sciences

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Questions?

› Github.com/krikis/nomad