Conflict-free Replicated Data Types (CRDTs)

An Overview

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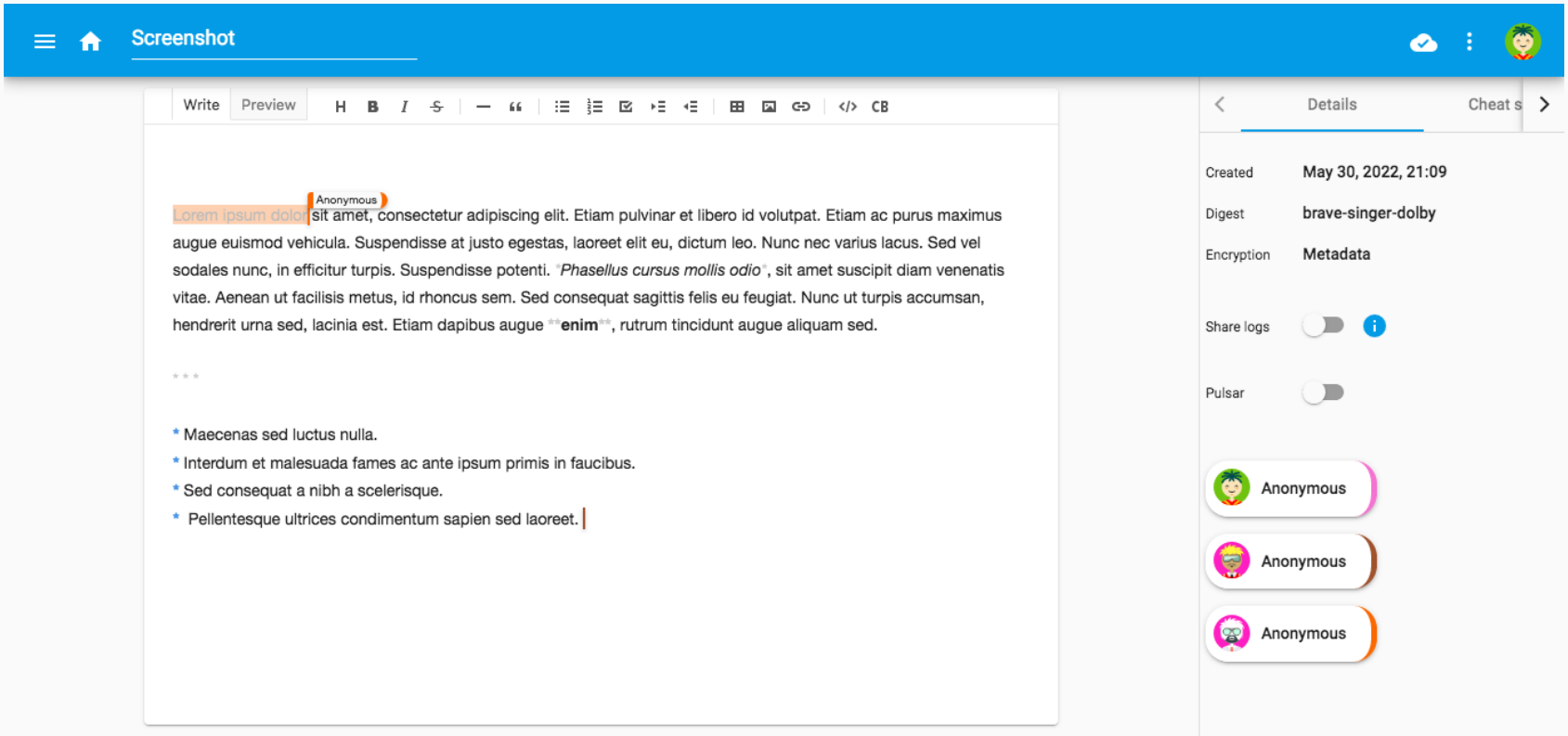
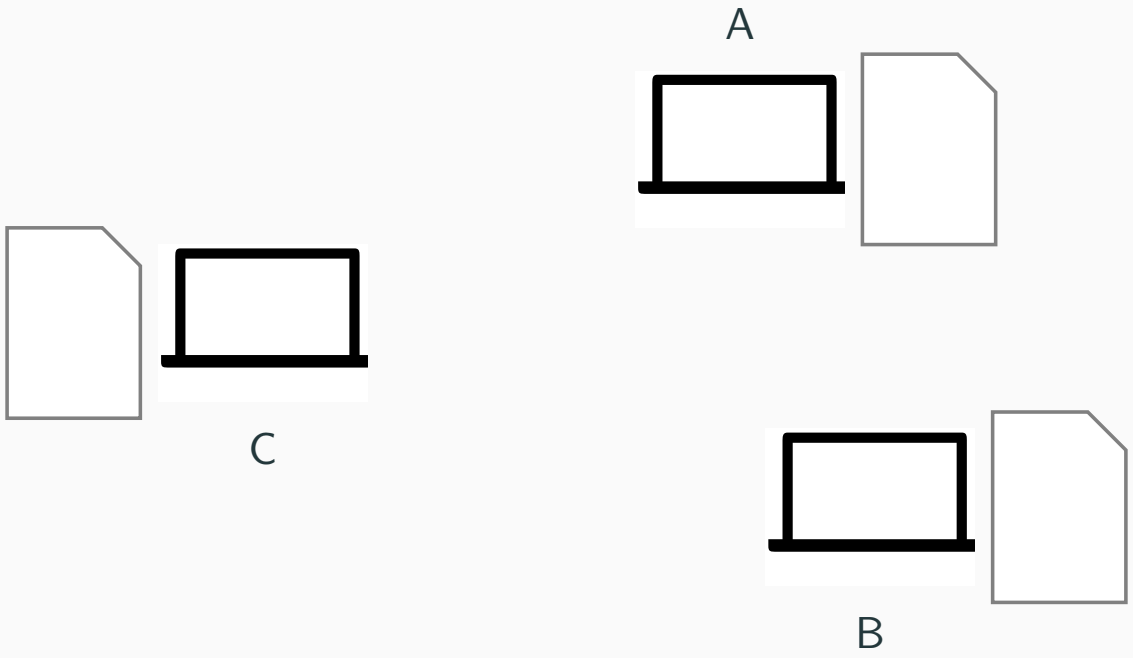
MUTE



- Peer-to-Peer (P2P) application
- Allow to edit collaboratively text documents
- Ensure ownership and privacy of data
- Part of the Local-First Software [Kle+19] trend

Data replication in P2P systems



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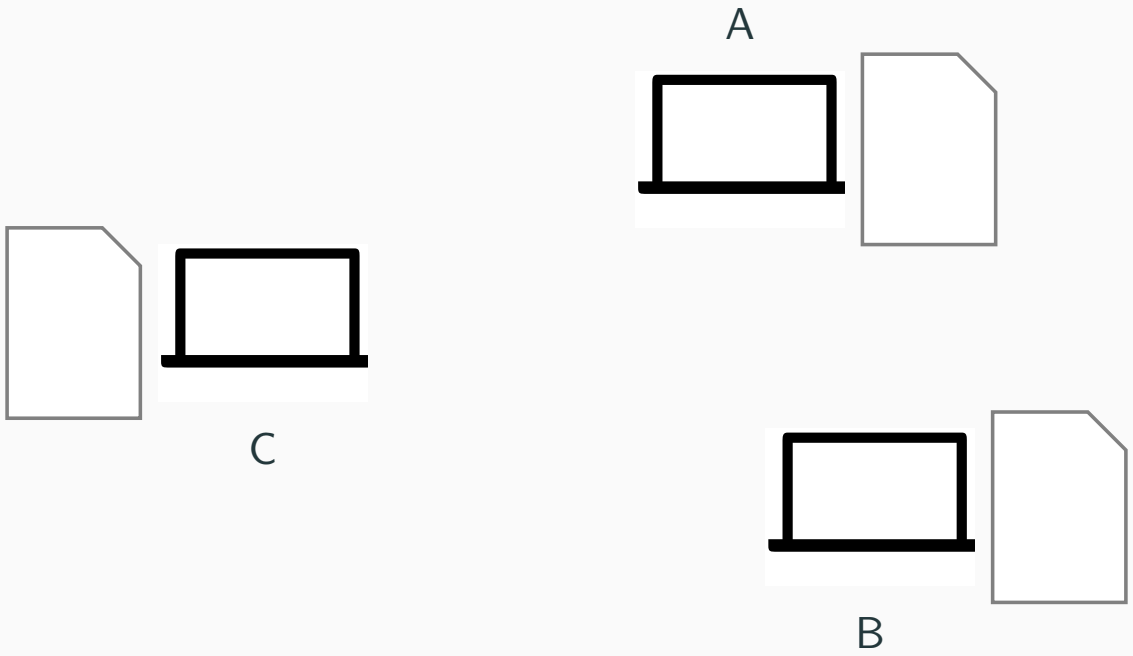

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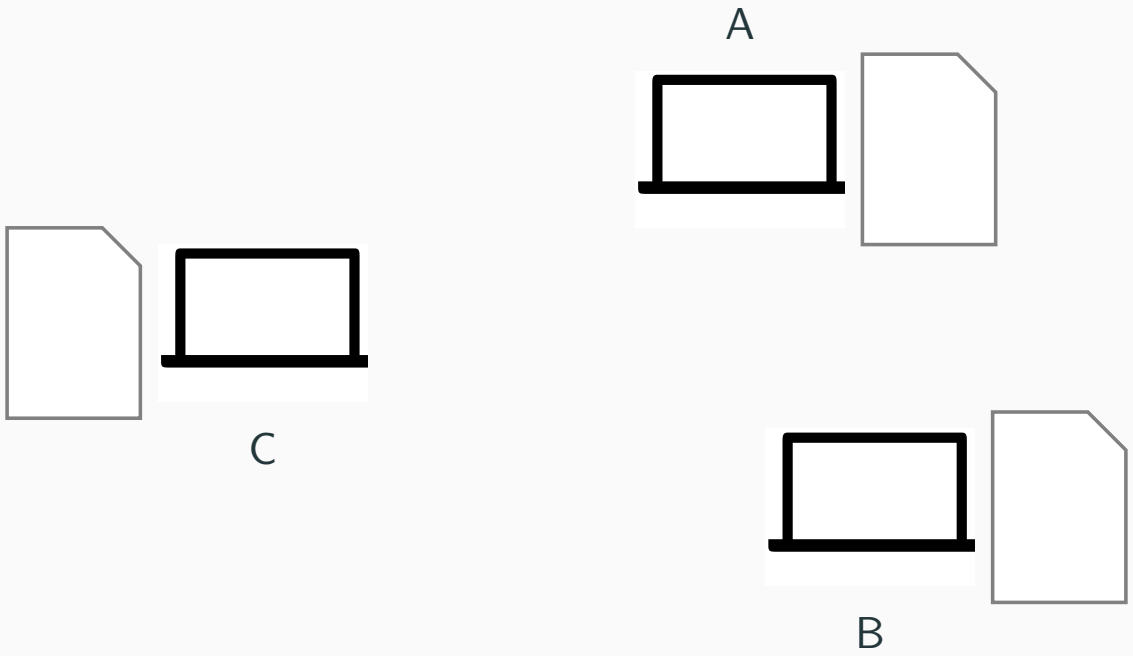

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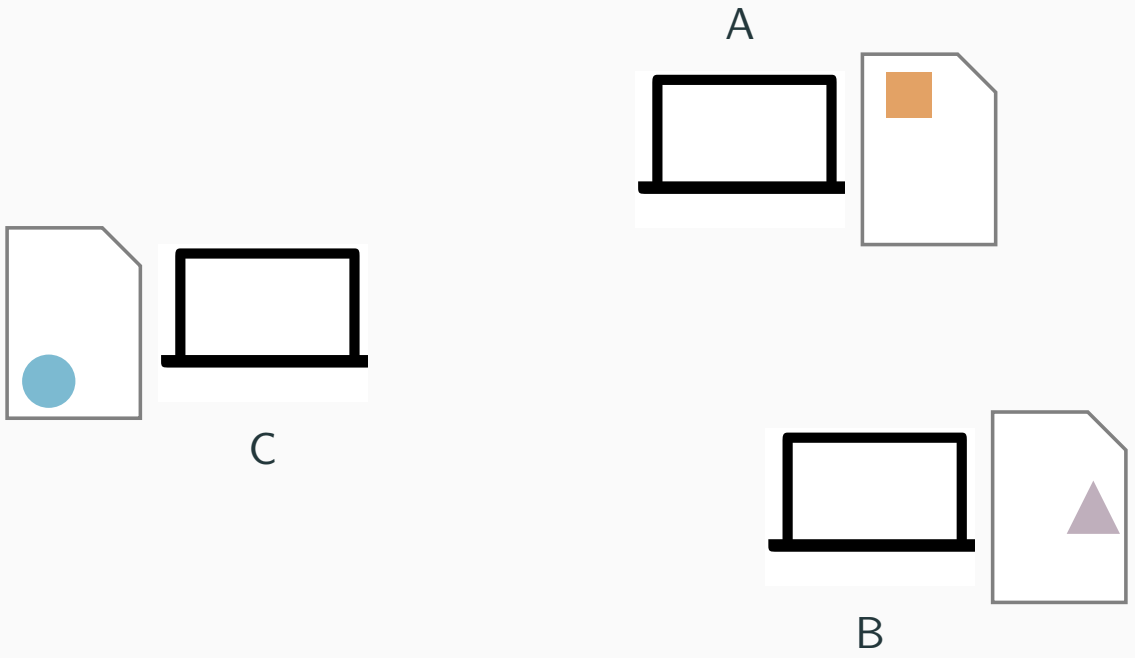

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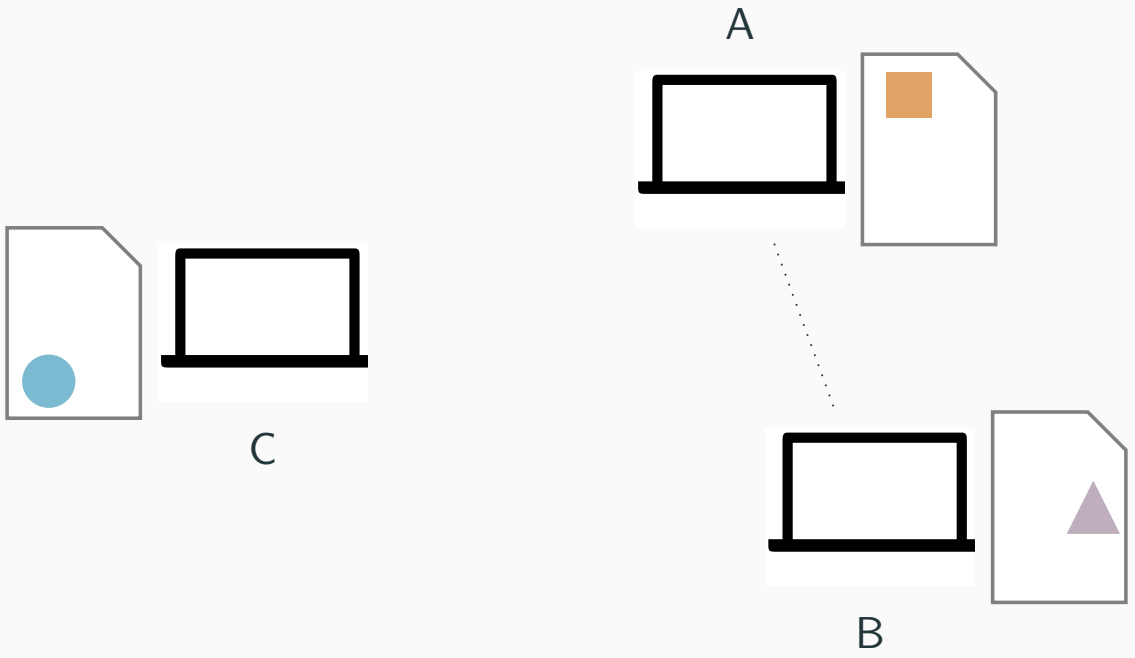

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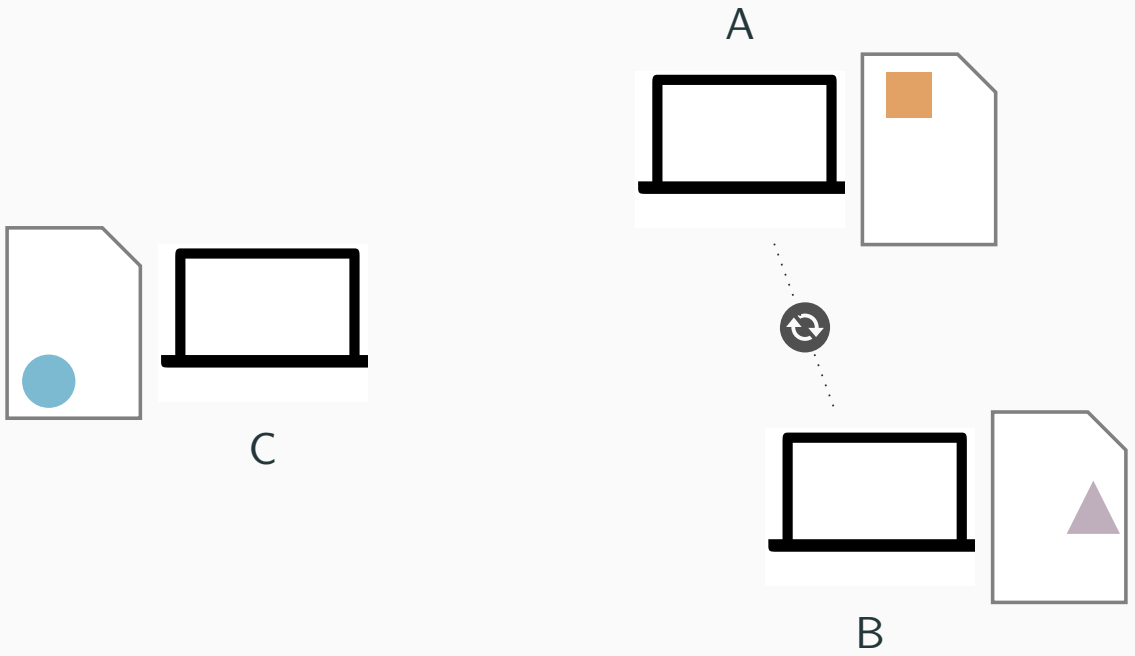

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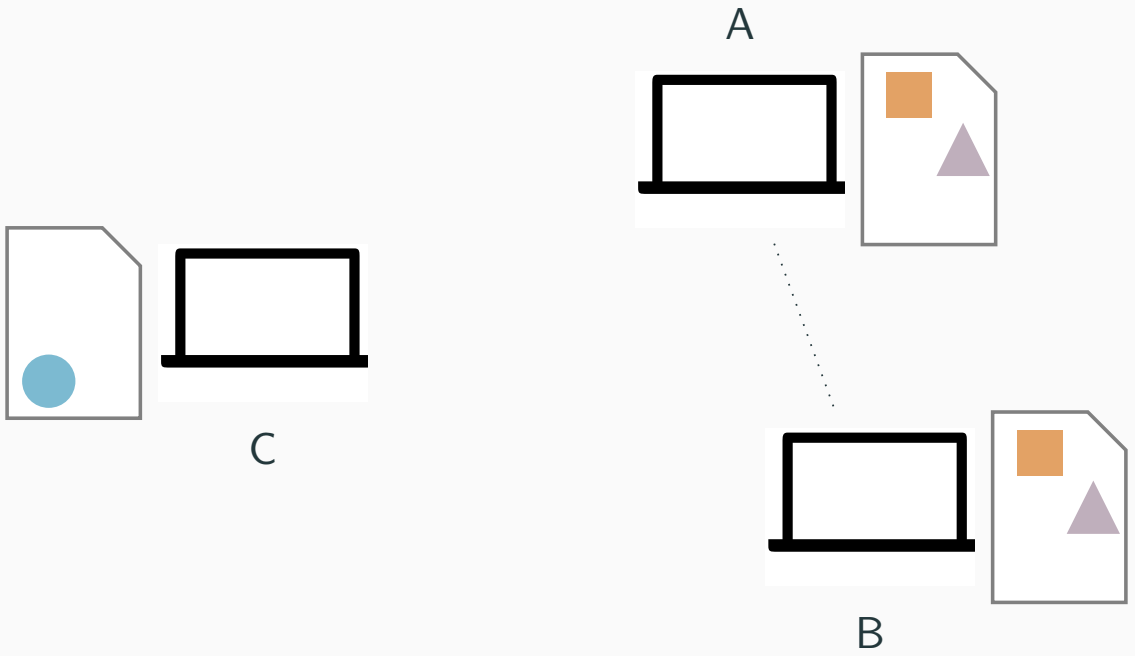

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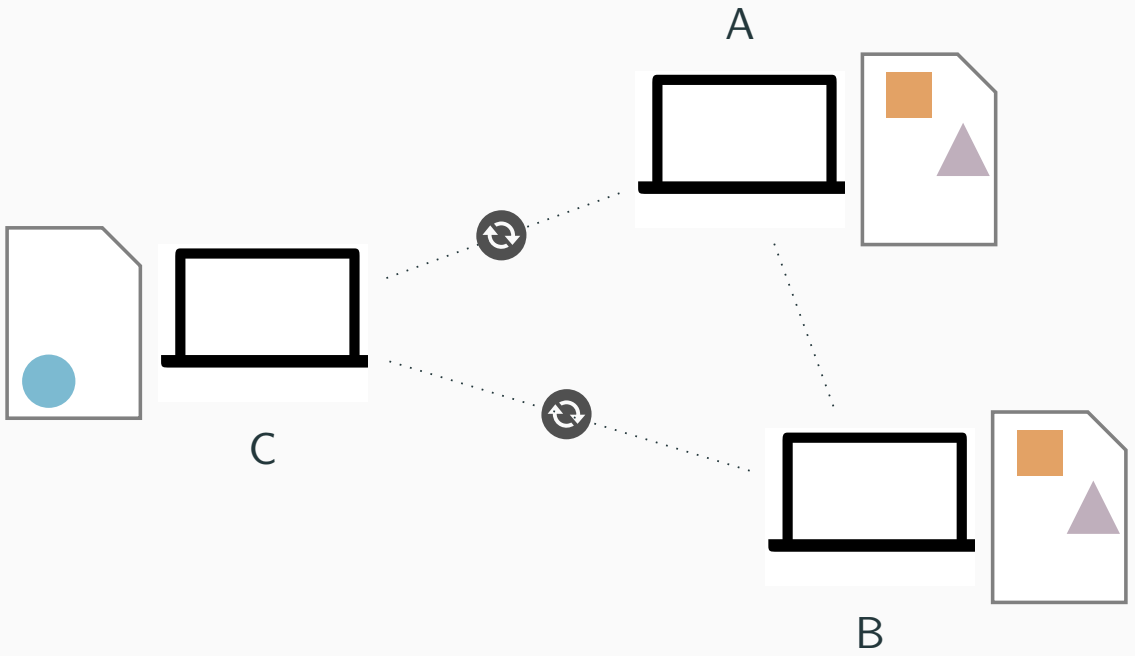

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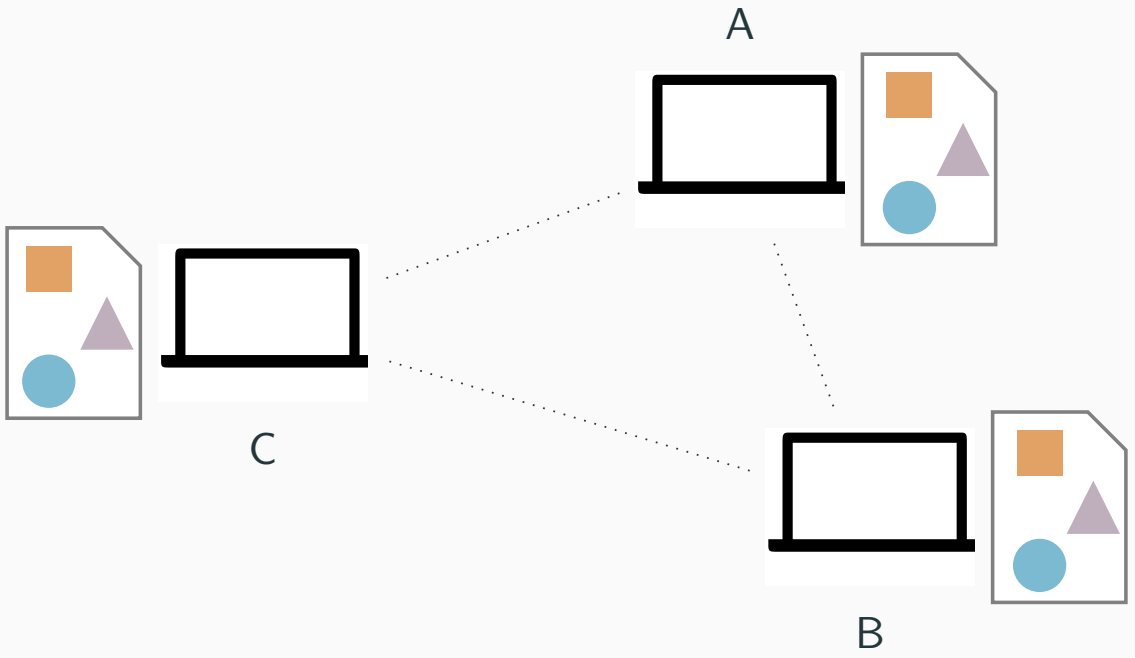

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- ...Despite different integration orders of updates

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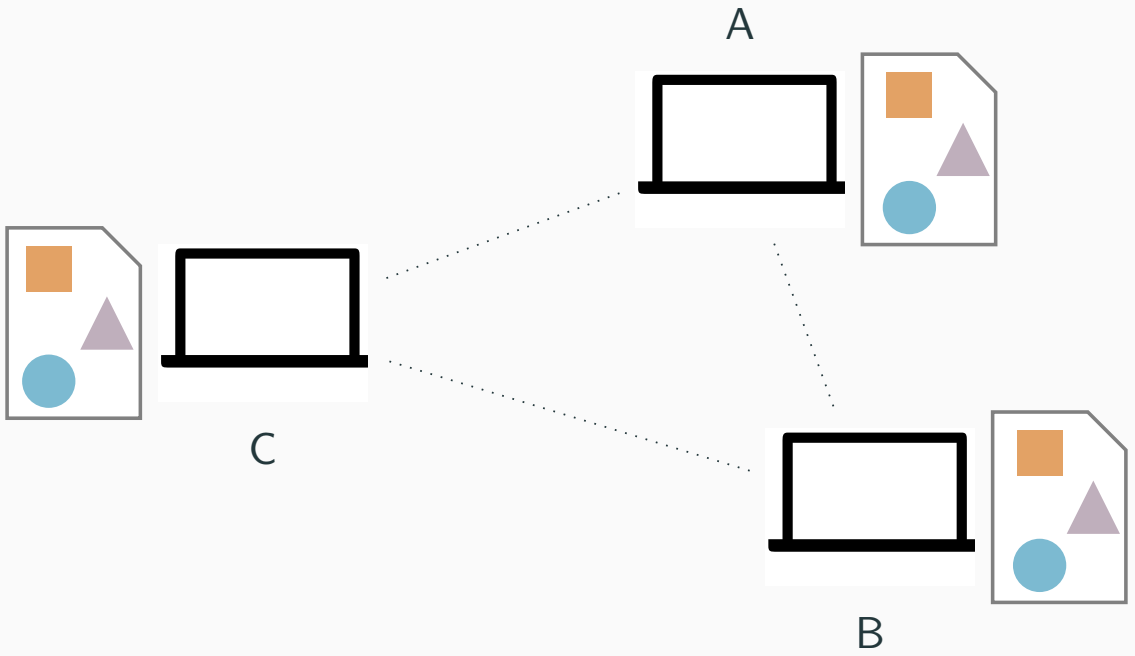

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Require *conflict resolution mechanisms*

Conflict-free Replicated Data Types (CRDTs) [Sha+11]

- Nouvelles spécifications des types de données, e.g. *Ensemble* ou *Séquence*
- Incorpore nativement mécanisme de résolution de conflits

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Cohérence forte à terme

Ensemble des noeuds ayant intégrés le même ensemble de modifications obtient des états équivalents, sans nécessiter d'actions ou messages supplémentaires

Bibliographie i

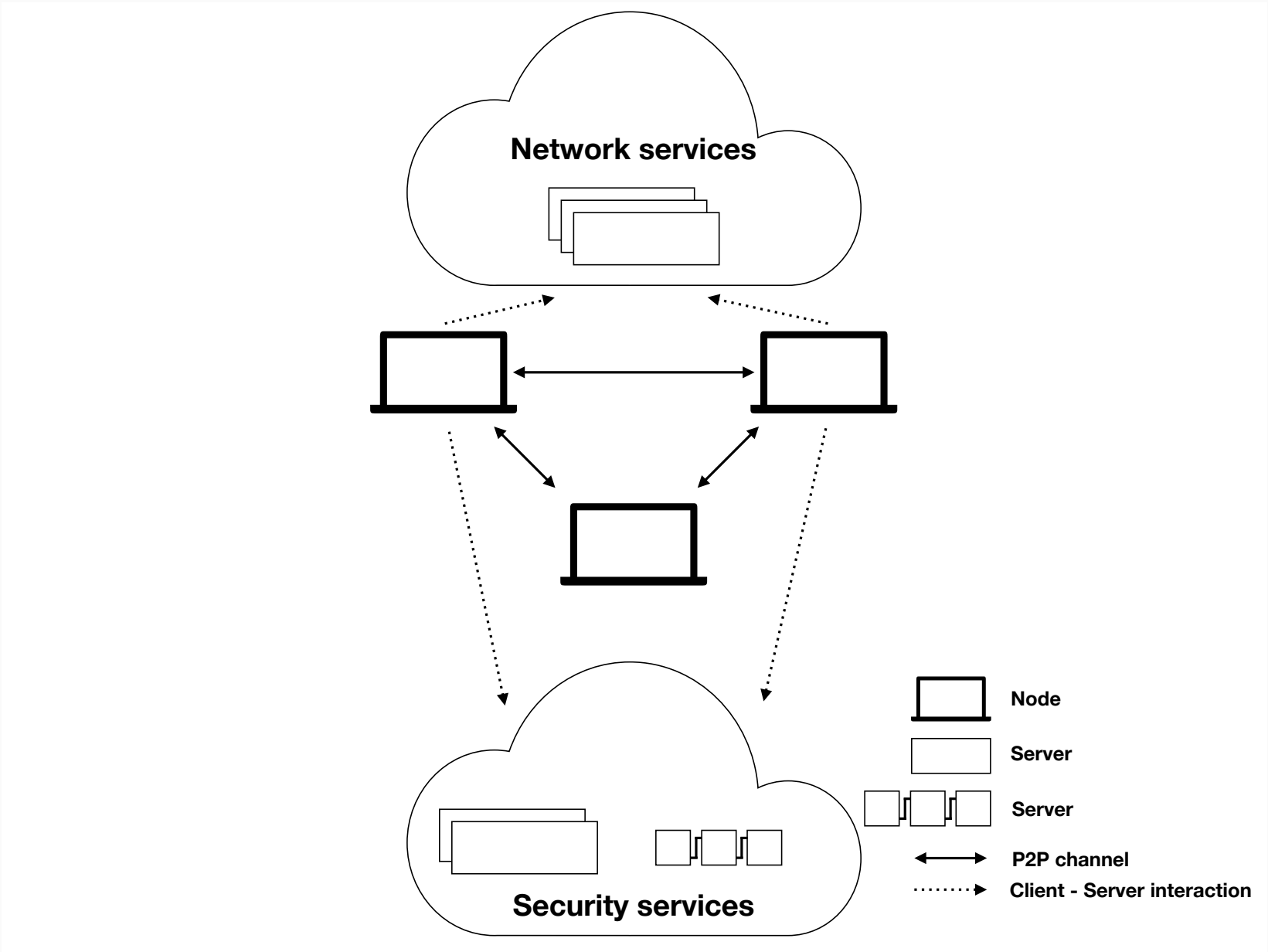
[Kle+19] Martin Kleppmann et al. **"Local-First Software: You Own Your Data, in Spite of the Cloud".** In: *Proceedings of the 2019 ACM SIGPLAN International Symposium on New Ideas, New Paradigms, and Reflections on Programming and Software*. Onward! 2019. Athens, Greece: Association for Computing Machinery, 2019, pp. 154–178. ISBN: 9781450369954. DOI: 10.1145/3359591.3359737. URL: https://doi.org/10.1145/3359591.3359737.

[Ter+95] Douglas B Terry et al. **"Managing Update Conflicts in Bayou, a Weakly Connected Replicated Storage System".** In: *SIGOPS Oper. Syst. Rev.* 29.5 (Dec. 1995), pp. 172–182. ISSN: 0163-5980. DOI: 10.1145/224057.224070. URL: https://doi.org/10.1145/224057.224070.

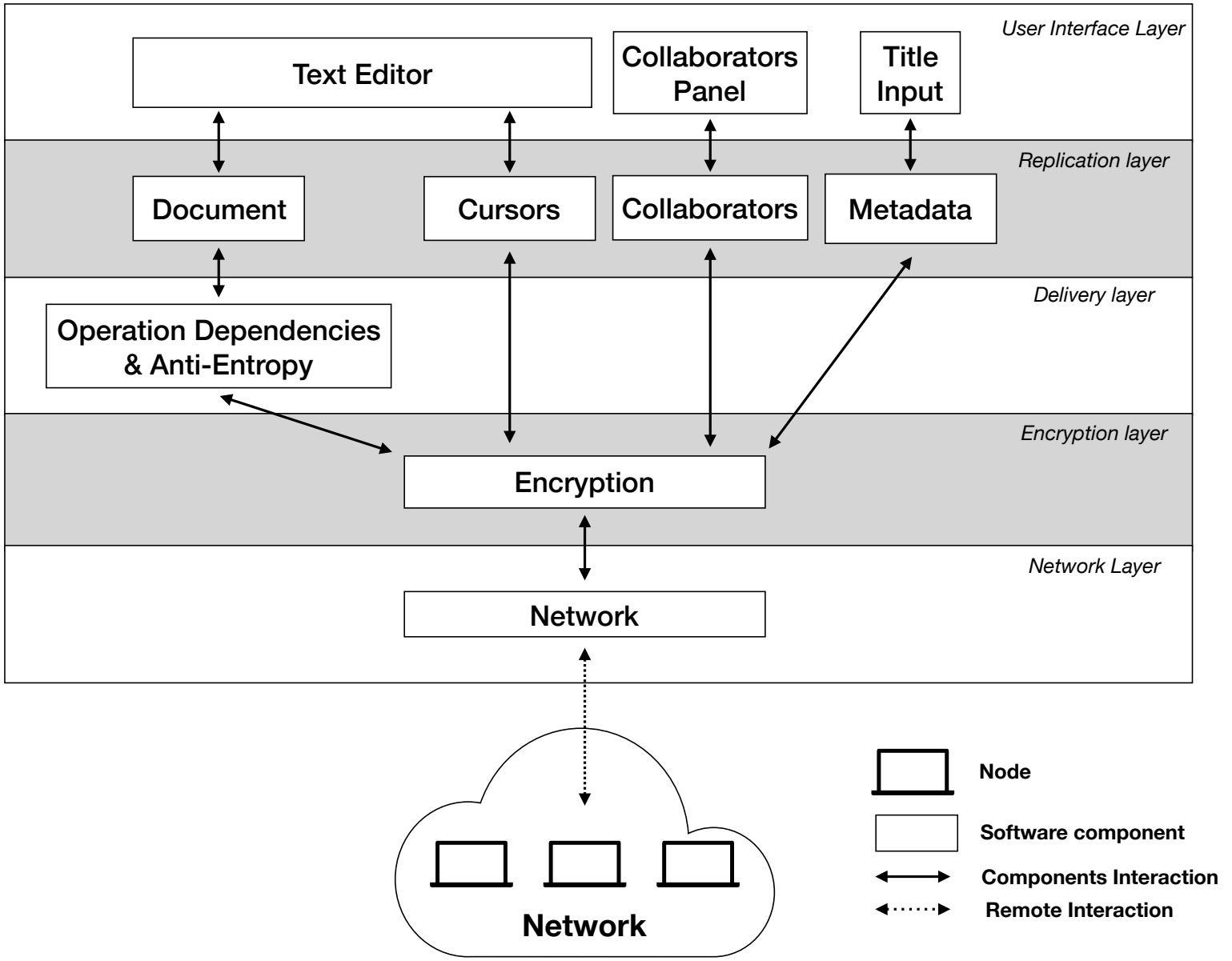
[Sha+11] Marc Shapiro et al. **"Conflict-Free Replicated Data Types".** In: *Proceedings of the 13th International Symposium on Stabilization, Safety, and Security of Distributed Systems*. SSS 2011. 2011, pp. 386–400. DOI: 10.1007/978-3-642-24550-3_29.

Back-up slides

Architecture système de MUTE



Architecture logicielle de MUTE



Contributions

Document

- Implémentation des CRDTs LogootSplit et RenamableLogootSplit

Operation Dependancies & Anti-Entropy

- Implémentation des modèles de livraison pour LogootSplit et RenamableLogootSplit
- Implémentation d'un mécanisme d'anti-entropie (détection et échange des opérations perdues)

Ingénierie logicielle

- Mise en place des processus d'intégration continue et de livraison continue pour les librairies `mute-structs`* et `mute-core`*

*`https://github.com/coast-team/mute-structs`
*`https://github.com/coast-team/mute-core`

Contributions - suite

Network

- Supervision de la réalisation d'un *Proof of Concept* basé sur l'utilisation d'un *log-based message broker*

Collaborators

- Supervision de l'adaptation et l'implémentation de SWIM, un protocole d'appartenance au réseau