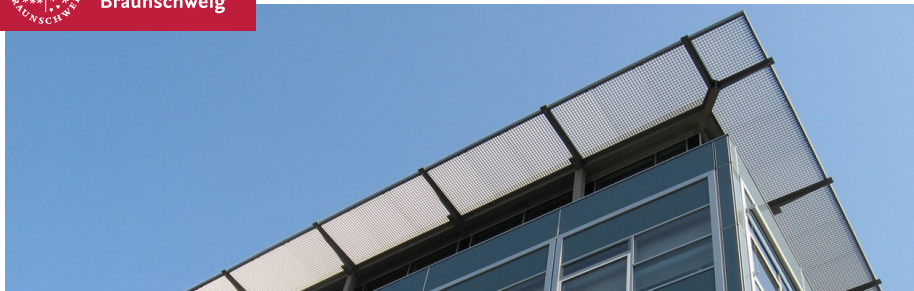




Technische
Universität
Braunschweig



Low-Latency Network-Scalable Byzantine Fault-Tolerant Replication

12th EuroSys Doctoral Workshop (EuroDW 2018)

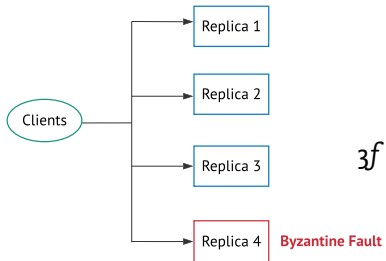
Ines Messadi, TU Braunschweig, Germany, 2018-04-23

New PhD student (Second month) in the distributed systems group

Research area: Resiliency of distributed systems, Byzantine Fault Tolerance

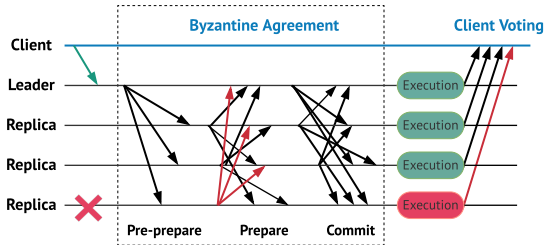
Advisor: Rüdiger Kapitza

Overview

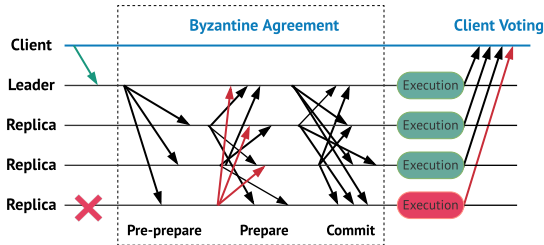


$3f + 1$ nodes to tolerate f faults

Overview

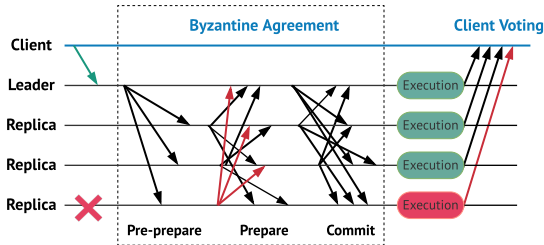


Overview



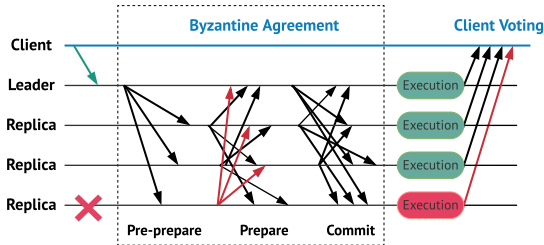
- **Problem:** Agreement latency overhead & message complexity in BFT

Overview



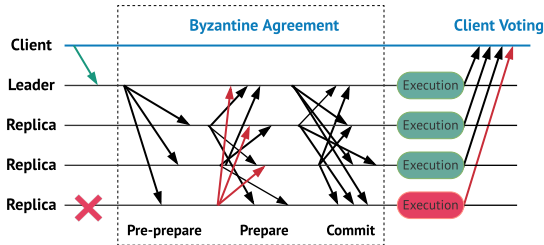
- **Problem:** Agreement latency overhead & message complexity in BFT
- **Reason:** Multiple communication rounds & slow TCP networking

Overview



- **Problem:** Agreement latency overhead & message complexity in BFT
- **Reason:** Multiple communication rounds & slow TCP networking
- **New trend:** Availability of modern hardware technology such as Remote Direct Memory Access (RDMA)

Overview



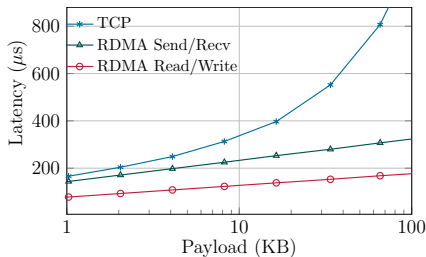
- **Problem:** Agreement latency overhead & message complexity in BFT
 - **Reason:** Multiple communication rounds & slow TCP networking
 - **New trend:** Availability of modern hardware technology such as Remote Direct Memory Access (RDMA)
 - **Consequence:** A need to redesign current BFT systems
- ↪ **How can we build a secure fast and scalable RDMA-based BFT?**

Remote Direct Memory Access (RDMA)

■ Why RDMA ?

- Zero-copy data transfer
- Reduce communication CPU usage

↪ Low latency and CPU efficiency



Remote Direct Memory Access (RDMA)

■ Why RDMA ?

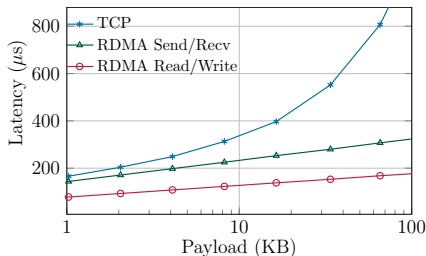
- Zero-copy data transfer
- Reduce communication CPU usage

↪ Low latency and CPU efficiency

■ Challenges

- Different communication mechanisms
- Inappropriate design ⇒ **unexpected bad performance**
- Security issues

↪ Require an explicit design of applications



Remote Direct Memory Access (RDMA)

■ Why RDMA ?

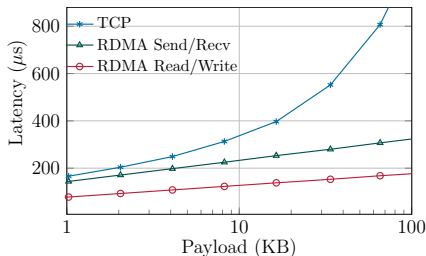
- Zero-copy data transfer
- Reduce communication CPU usage

↪ Low latency and CPU efficiency

■ Challenges

- Different communication mechanisms
- Inappropriate design ⇒ **unexpected bad performance**
- Security issues

↪ Require an explicit design of applications



Observation

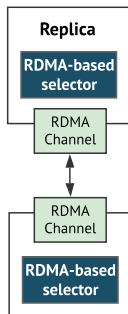
Necessity to redesign the existing BFT protocols for RDMA

Towards building RDMA-based BFT

- Basis BFT protocol: **Hybster** [Behl et al., EuroSys'17]
 - Building an RDMA-tailored BFT protocol
 - Investigating RDMA communication tradeoffs
 - Counter-measures for the resilient use of RDMA

Towards building RDMA-based BFT

- Basis BFT protocol: **Hybster** [Behl et al., EuroSys'17]
 - Building an RDMA-tailored BFT protocol
 - Investigating RDMA communication tradeoffs
 - Counter-measures for the resilient use of RDMA
 - Preliminary approach
 - Build similar interfaces to TCP programming using RDMA
- ⇒ Aiming to take fully advantage of RDMA



Towards building RDMA-based BFT

- Basis BFT protocol: **Hybster** [Behl et al., EuroSys'17]
 - Building an RDMA-tailored BFT protocol
 - Investigating RDMA communication tradeoffs
 - Counter-measures for the resilient use of RDMA
- Preliminary approach
 - Build similar interfaces to TCP programming using RDMA

⇒ Aiming to take fully advantage of RDMA
- Example applications: Blockchain & coordination services

