DISTRIBUTED COMPUTATION OF CRITICAL PATH

Pierre-Frédérick DENYS
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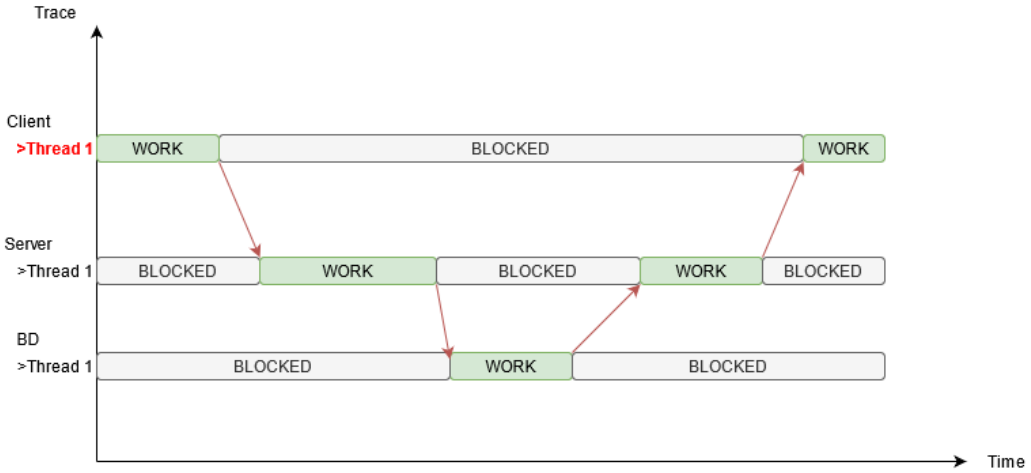
Agenda

- Introduction
- Challenges about critical path computation
- Proposed solution
- Future work and usecases
- Conclusion

Quick reminder about Critical Path

Reminder about critical path



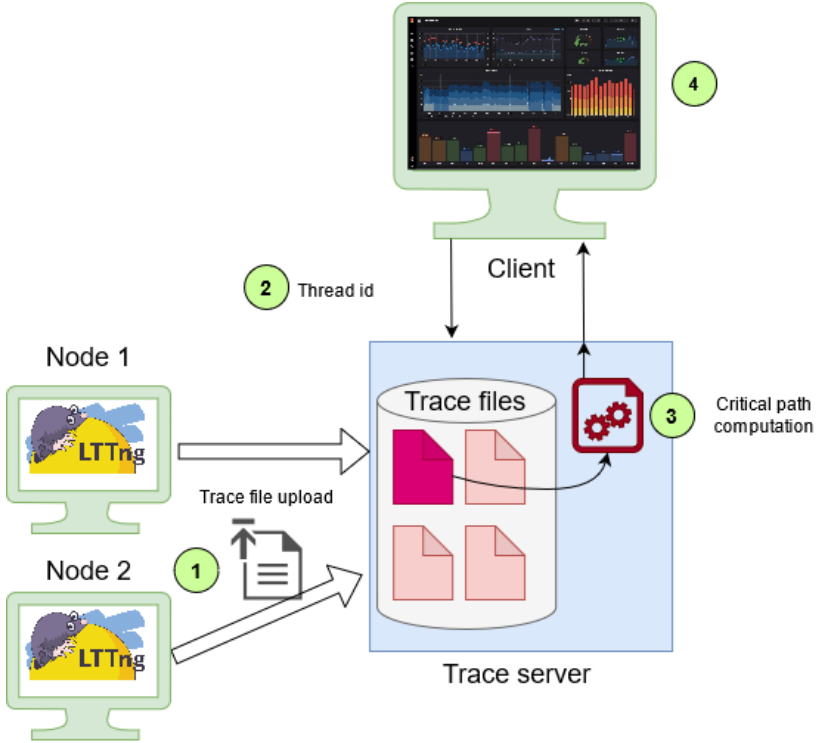
- The data structure as a two-dimensional doubly linked list, where horizontal edges are labelled with task states, and where vertical edges are signals between tasks (either a wake-up or a network packet)
- The active path of execution is the execution path where all blocking edges are substituted by their corresponding subtask

Critical path usage

- Need for large distributed systems tracing
  - HPC systems
  - MPI clusters
  - Kubernetes and container clusters
- Critical path computation not optimized
- Transfer of trace files on analysis node is mandatory
- Critical path unavailable in Theia and Grafana plugin

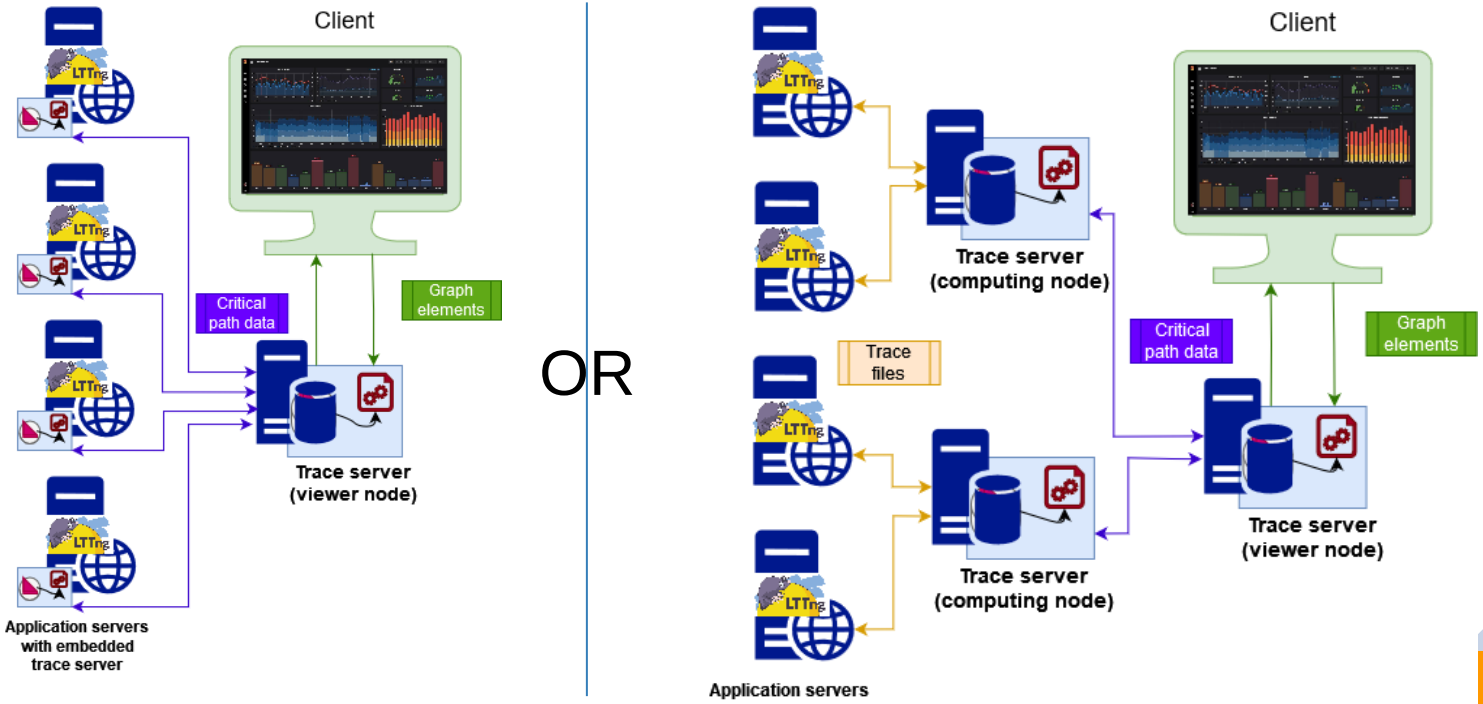
Actual architecture and challenges

Actual architecture in Trace Compass

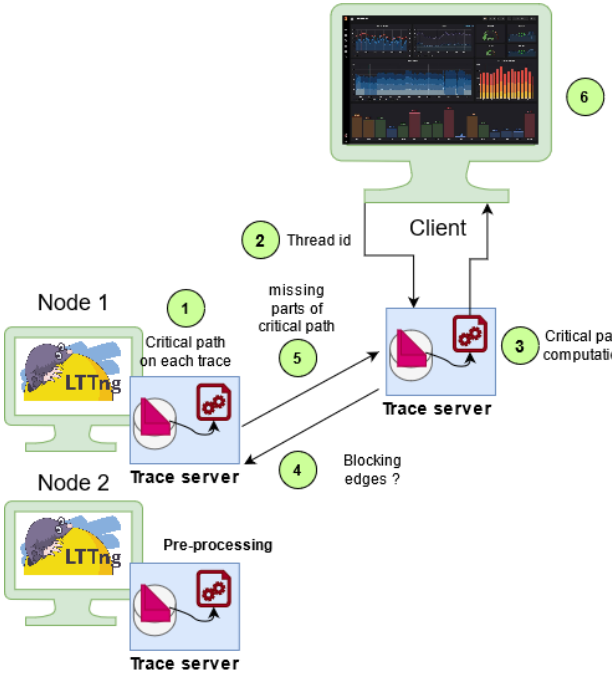


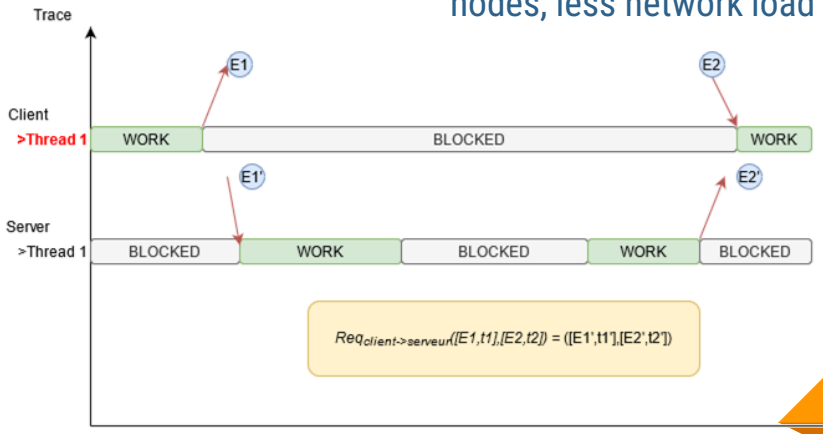
Proposed solution : Parallelization of the architecture

Parallelisation of the computation : architecture



Parallelisation of the computation : algorithm





- Pre-processing of critical path on each node
- On client request, process the critical path of the trace, and ask only the missing parts of the path to other nodes
- Distributed processing, suitable for large number of nodes, less network load

My work

- Improve algorithm to :

Compute execution graph, outbound and inbound edges of critical path of each trace independently on computing nodes

Be able to process the full critical path from pre-processed parts on viewer node
Send minimum data between computing and viewer nodes

- Storage of critical path on disk :

Usage of state system for horizontal edges and segment store for vertical ones

Future work and usecases

What remains to be done ?

- Implement a simple and efficient communication pattern between trace servers (computing and viewer nodes)
- Test and characterize overhead and efficiency of new distributed method on several usecases

Usecases

- Target usecases :
  - MPI cluster : follow a MPI task between computing nodes
  - Kubernetes cluster : follow a request in a distributed web application
  - ZeroMQ communication : follow a message exchange between several containers

Conclusion

Conclusion

- Parallelisation of critical path computation
- Efficient communication pattern for computing process
- Integration of Critical path in Trace Server Protocol (for Theia and Grafana viewers)


Thank you for
listening !