Reducing communications on a dense Cholesky factorization

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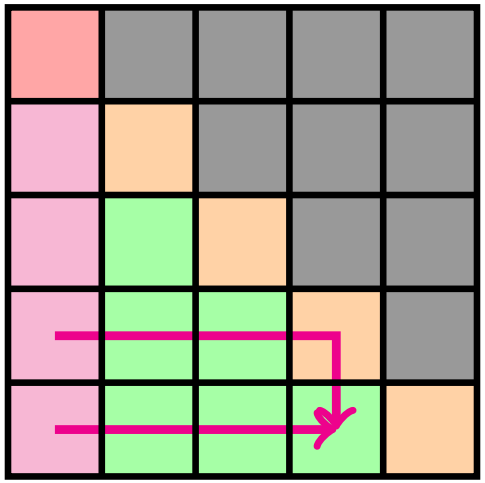
Contexte

1. Computer science department of the university of Bordeaux
2. Topal's team with Olivier Beaumont, Lionel Eyraud-Dubois and Mathieu Vérité
3. Internship: Creation of data allocation and scheduling strategies.

Cholesky Factorization

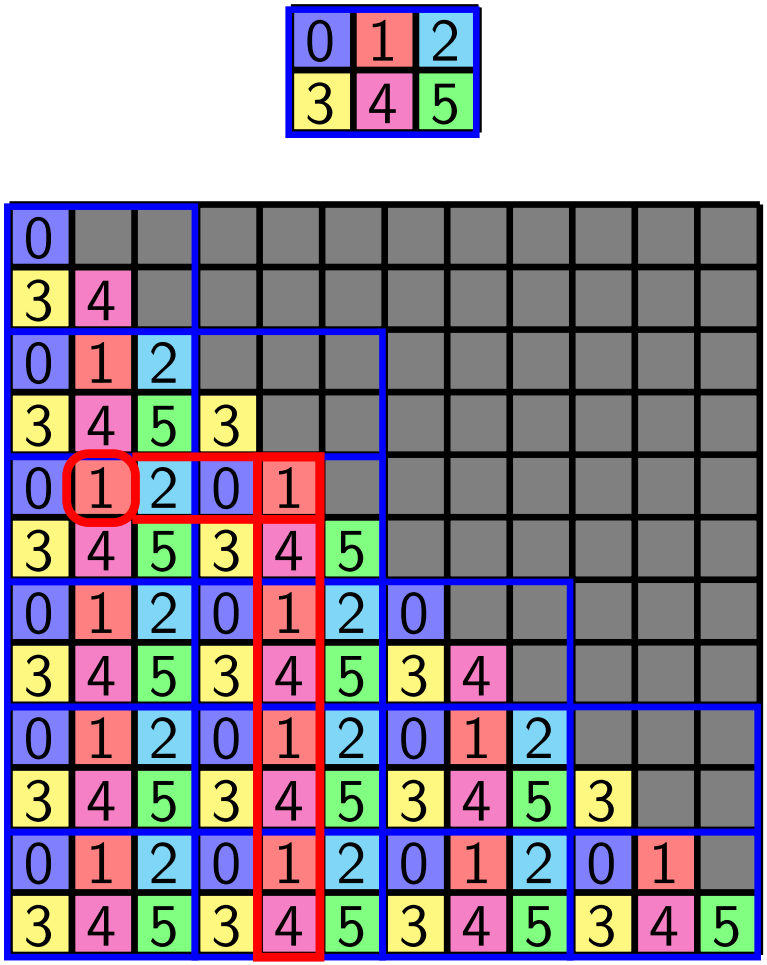


Point to point communications

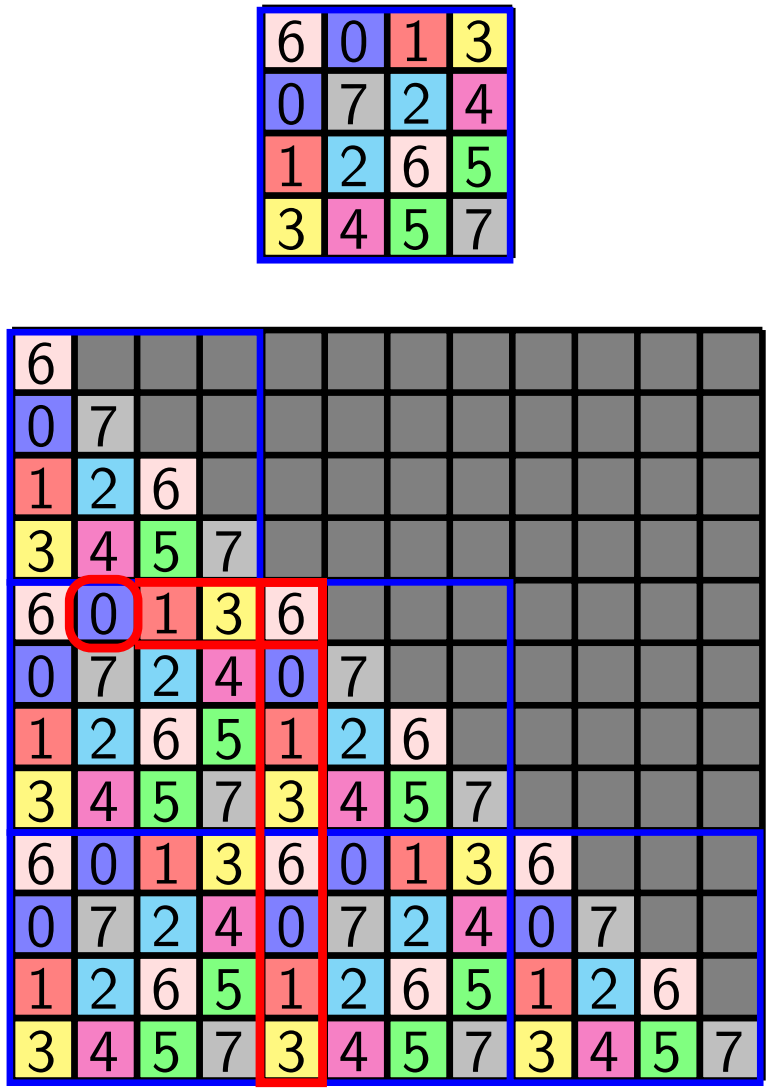
$$Ax = b \text{ and } A = LL^T$$

$$\forall i,j \in \{1 \dots S\} \; \forall k \in \{1 \dots P\} x_{i,j}^k \in \{0;1\}$$
$$\forall i \in \{1 \dots S\} \; \forall k \in \{1 \dots P\} y_i^k \in \{0;1\}$$

State of the art: 2DBC and SBC



2DBC



SBC

Pattern research with a linear problem solver

1. Description of the problem with constraints
2. Using CPLEX to solve the problem

Constraints

$$
\begin{cases}
(1) \quad \forall i,j \in \{1 \dots S\} & \sum_{k \in \{1 \dots P\}} x_{i,j}^k = 1 & \text{allocation} \\
(2) \quad \forall i,j \in \{1 \dots S\}\ \forall k \in \{1 \dots P\} & \begin{matrix} x_{i,j}^k \leqslant y_i^k \\ x_{j,i}^k \leqslant y_i^k \end{matrix} & \text{Cost trigger} \\
(3) \quad \forall k \in \{1 \dots P\} & m \leqslant \sum_{i,j \in \{1 \dots S\}} x_{i,j}^k \leqslant M & \text{load distribution} \\
(4) \quad \forall i \in \{1 \dots S\} & \sum_{k \in \{1 \dots P\}} y_i^k \leqslant \alpha & \text{communication}
\end{cases}
$$

Pattern research with a greedy algorithm

Trying to find another method more time-efficient. An algorithm on two steps:

1. For every node, find the tiles where it's the more efficient
2. Using a coupling algorithm to find what are the best tiles for every nodes

What's next?

After obtaining results from the two methods I will test them on plafrim to see if the time and communications are reduced.