ATSYS

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Project proposal: Shortest Path Algorithm for Material Transportation

Background

In the world of modern industry, a streamlined and optimized material transport process not only reduces operational costs but also enhances overall productivity. Hence, a robust shortest path algorithm could be required by plant managers to improve production efficiency. This project aims to develop a shortest path algorithm in SQL that will return a list of shortest paths between source and destination through a list of devices, ultimately minimizing the time taken for material transportation.

Specifications

The factory could be mapped out as a graph. Several types of devices are available, but only certain ones could be selected as source or destination. Divergent device could transfer the material to multiple destinations, and convergent device could take in materials from multiple sources.

The shortest path should connect the source and destination while minimising the cost.
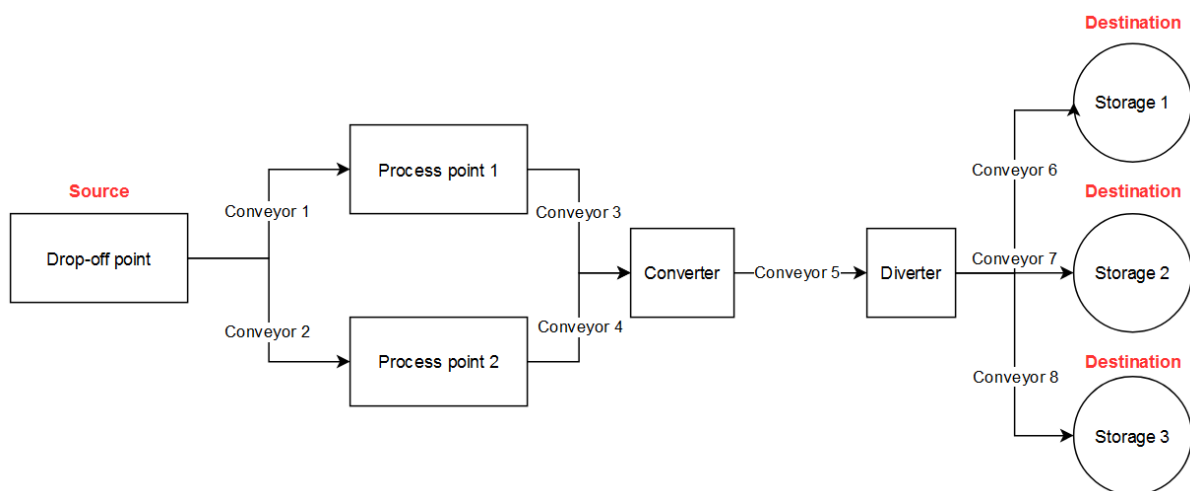

Figure 1 Example Factory Overview

Deliverables

The major deliverables of this project are a SQL function implementing the shortest paths algorithm, as well as a device database that the function operates on.

The SQL script should be able to:

1. Return a list of five shortest paths for the given source and destination ordered by cost.
2. Exclude devices that are faulted or in use by another path currently running.
3. Work with divergent and convergent devices to handle transporting from one source to multiple locations, and vice versa.
4. Reasonably scale up to larger sites with more devices.

Students should use MSSQL (recommended) or MySQL. It is recommended to use node tables and edge tables in MSSQL to store the graph information. Sufficient documentation should be provided to assist knowledge transfer. Further extensions such as optimising over multiple constraints are possible.