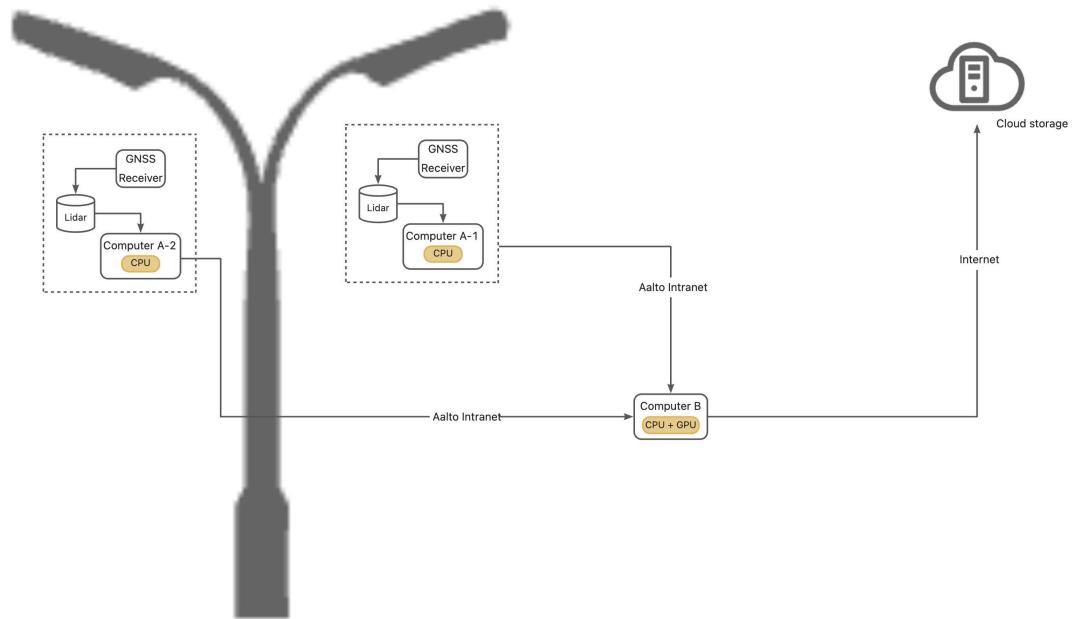


System Architecture and Resource Plan for LiDAR DATMO

Project Requirements

- **Multi-LiDAR Integration:** Integrate multiple LiDAR data streams for pedestrian trajectory tracking.
- **Data Storage:** Store raw LiDAR data, detection and tracking results.
- **7x24h Operation**
- **Software Framework:** Develop the software within the ROS2 ecosystem, implemented as ROS nodes.

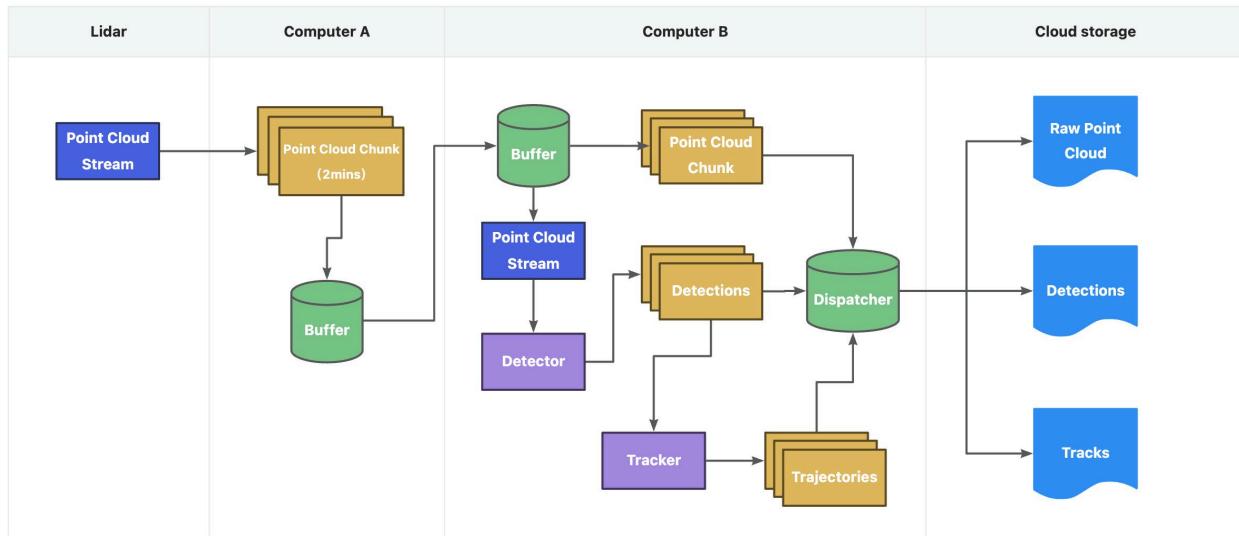
System Architecture



Each LiDAR is directly connected via Ethernet to a "Thin Computer A" (CPU-only). Computer A processes the collected data streams through spatial cropping and compression via the Aalto Intranet, packaging the data into individual chunks.

These chunks are then asynchronously transferred to “Computer B,” where they are restored into a point cloud stream. The Detector and Tracker run on Computer B, consuming the point cloud stream directly.

In this architecture, all GPU-intensive computations are offloaded to a remote server.



Advantages

- **Decoupling of computation from physical constraints:** Unlike edge-side GPU deployments, this architecture leverages centralized GPU clusters, providing virtually unlimited and scalable computational power.
- **High reliability:** With integrated buffering and retransmission, the system can handle temporary network issues without losing any data.
- **Good scalability:** The architecture has the potential to support additional LiDAR units with minor software adjustments.

Disadvantages

- **High bandwidth requirement:** A high-speed network connection is required between Computer A and Computer B.

Resource Requirements

Hardware

Lidar *2

- Thin Computer *2 (Computer A)
- GPU resource (Computer B)
- Cloud Storage

Other

- Network capacity:** Each “LiDAR + Computer A” setup requires a 1 Gbps campus network connection (either wired or wireless).

Issues

How to connect the LiDAR to the Aalto Intranet.

- **Option 1:** Use “Aalto” Wi-Fi (Potential issues: instability or bandwidth below 500Mbps).
- **Option 2:** Apply for a wired Ethernet connection to the “Aalto” Net (Recommended).

Do we need real-time detection?

If real-time tracking is required, the “Point Cloud Chunk” method will be replaced with a “Point Cloud Stream.”

	Point Cloud Chunk	Point Cloud Stream
Delay	Yes (set from seconds to minutes).	No (Real-time).
Data Loss	No (Guaranteed by buffer).	Possible (due to network jitter).