How do `/cmd_vel`, `/odom`, and `/scan` work together to enable robot navigation?

In ROS2-based mobile robots, navigation depends on the integration of control commands, localization data, and environmental perception. The topics `/cmd_vel`, `/odom`, and `/scan` serve these three fundamental purposes.

The `/cmd_vel` topic carries velocity commands to control the robot's motion. It uses the `geometry_msgs/msg/Twist` message type, which defines linear and angular velocities. When a node (e.g., `teleop_keyboard` or a path planner) publishes to `/cmd_vel`, the robot's base controller interprets these commands and actuates the wheels accordingly.

As the robot moves, its estimated position and orientation are published to `/odom` using the `nav_msgs/msg/Odometry` message. This information is typically derived from wheel encoders or other sensors and is essential for tracking the robot's pose over time (dead reckoning). It also provides input for higher-level tasks like SLAM and path planning.

Simultaneously, the `/scan` topic provides 2D range data from the LIDAR sensor. Using the `sensor_msgs/msg/LaserScan` message type, it enables obstacle detection, mapping, and collision avoidance.

Together, these topics form a closed-loop navigation system: `/cmd_vel` initiates motion, `/odom` tracks displacement, and `/scan` ensures safe interaction with the environment. Their coordination enables both manual control and autonomous navigation in dynamic environments.