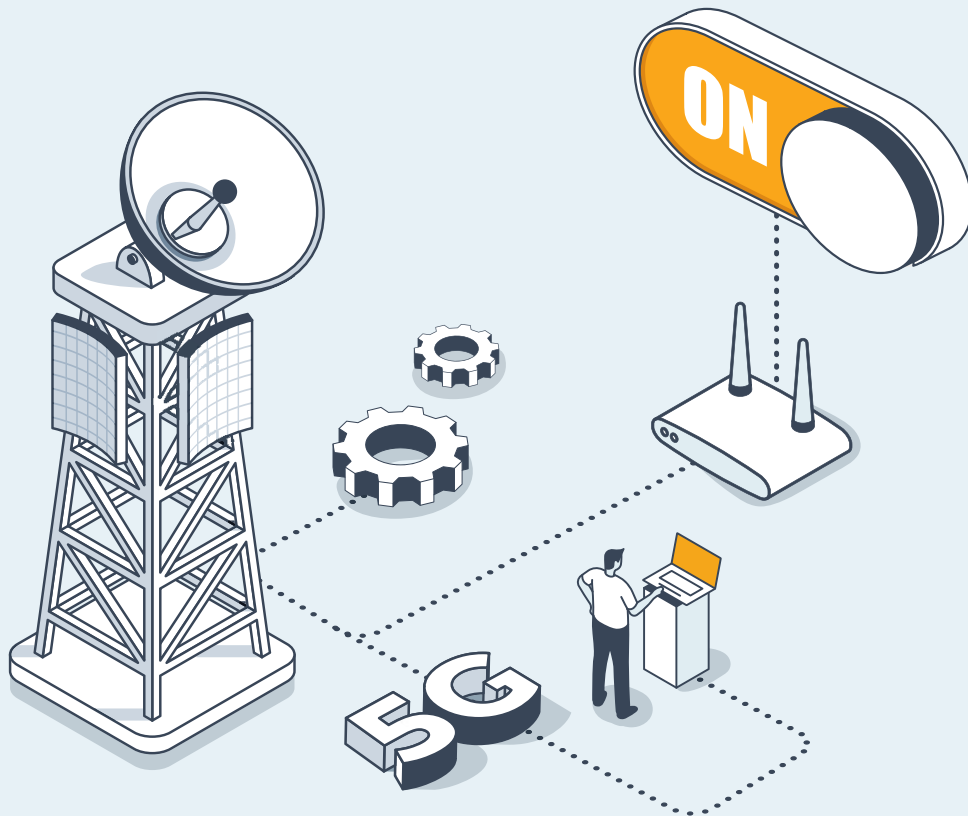# Steering in Cellular Networks: Optimizing IoT Connectivity

Executive Summary

The rapidly expanding landscape of IoT deployments requires reliable, efficient, and cost-effective connectivity solutions. One key technology that addresses this challenge is network steering, which enables IoT devices to connect to the most suitable network based on specific criteria such as signal quality, cost, performance, and regulatory compliance. This white paper explores the concept of steering in cellular networks, focusing on its application in IoT environments and the benefits it provides.

Steering involves guiding a device to connect to a preferred network when it is roaming outside its home network. For IoT devices, which often operate without user interfaces, automated and intelligent network selection is essential for maintaining optimal performance. The use of steering trees, a set of predefined rules for network selection, helps IoT deployments achieve consistent and efficient connectivity.

floLIVE offers a comprehensive steering solution that integrates three key methods—SIM-based, Core Network, and Billing-based steering—into a unified platform. This integration allows for granular control, dynamic network switching, and customization, ensuring that IoT devices always connect to the best possible network. By prioritizing customer needs over commercial agreements, floLIVE provides superior coverage, pricing, and quality of service for global IoT deployments.

What is Steering?

In cellular networks, "steering" refers to the mechanism by which a connectivity provider determines which network a device should connect to when it is roaming outside of its home network. By default, cellular devices connect to their "home" network—the network associated with the SIM card's issuing mobile operator. When devices move to other regions, the provider guides them towards preferred roaming partners. This guidance is called "Network Steering" or "Steered Roaming."
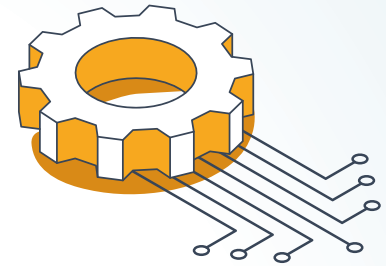
For consumer devices, manual network selection can be a solution when steering does not provide the best network. However, for IoT devices, this flexibility is not available. IoT devices often operate autonomously without a user interface, making a smart and automated approach to steering crucial. In addition, IoT devices can be highly sensitive to performance factors such as latency, error rates, and quality of service—parameters that directly impact their operation.

What is a Steering Tree?

A steering tree is an advanced form of steering used in IoT networks. It represents a set of predefined rules and conditions integrated into a Connectivity Management Platform (CMP) or the core network of a connectivity provider. These rules help guide IoT devices to the best available network, based on factors like signal strength, cost, performance requirements, roaming agreements, and regulatory compliance. Devices with steering trees embedded make autonomous decisions about network selection, ensuring constant, optimized connectivity without manual intervention. This is crucial for large-scale IoT deployments that involve many devices operating in various environments.

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# Steering and IoT: The Relationship

IoT deployments face distinct challenges compared to traditional mobile devices. IoT devices are often dispersed over large areas, operate with minimal power, and require consistent connectivity without user intervention. This is where steering and steering trees become essential tools.

- **Optimized Connectivity:** Steering trees provide IoT devices with the ability to always connect to the most optimal network, whether that means better signal strength, reduced costs, or compliance with local regulations.

- **Cost Control:** Network selection criteria can be set to prioritize networks with lower costs or better roaming agreements, which helps reduce connectivity costs for IoT deployments.

- **Improved Performance:** By prioritizing networks with lower latency or higher bandwidth, steering trees enhance the performance of real-time IoT applications like autonomous vehicles and telemedicine.

- **Simplified Management:** The use of steering trees simplifies network management for IoT deployments, reducing the need for manual network configuration and allowing streamlined automation.

Steering Methods for IoT Networks

There are three primary methods for steering IoT devices within a cellular network:

1. **SIM-Based Steering:** A SIM card can be configured with preferred Public Land Mobile Networks (PLMNs). The advantage of this approach is that the SIM doesn't waste energy attempting to connect to undesirable networks, conserving battery life. However, if a preferred network is unavailable, the device may not connect to any network, which can be problematic for mission-critical devices like medical or security systems.

2. **Core Network Steering:** In this approach, the SIM is allowed to connect to any available network, but the core network controls approvals or rejections. This method offers more control but can lead to long connection attempts, draining battery life. It is ideal for scenarios where flexibility is essential, such as in complex IoT deployments across different regions.

3. **Billing-Based Steering:** Network steering can also be managed through a real-time billing system, where connectivity is controlled based on data quotas and usage. This method allows for precise cost control but is less efficient in terms of battery life and requires significant communication between the SIM and the core network.
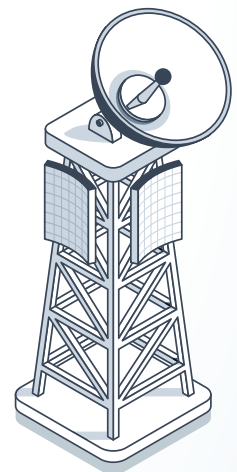
floLIVE Steering Solution for IoT Connectivity

floLIVE offers a comprehensive steering solution tailored to the unique needs of IoT. Unlike traditional mobile network operators that focus on directing devices to networks with the most favorable commercial terms, floLIVE aims to provide the best coverage, pricing, and quality of service based on the actual needs of the customer's devices. floLIVE integrates all three steering options (SIM, Core Network, and Billing) into a single platform, offering:

Advanced Steering Trees: floLIVE provides advanced steering tree capabilities within its core network. These steering trees allow granular control, ensuring devices can autonomously select the best network tailored to specific needs like performance or cost.

Dynamic Steering: floLIVE supports dynamic network switching, ensuring devices remain connected even in challenging conditions, such as coverage gaps or network issues. This is particularly useful for IoT applications where uninterrupted connectivity is crucial.

Granular Customization: floLIVE's steering solution enables custom steering configurations that can be adapted to customer-specific requirements or regional demands. This level of customization ensures that IoT devices always have access to the most appropriate network based on real-time conditions.

Seamless Integration: With the floLIVE CMP portal, customers can manage steering trees for all providers supported by the platform. The portal allows root users and MNO users to define steering trees, assign them to sub-accounts, and configure them for specific IMSIs, providing complete oversight and flexibility in managing network selection.

floLIVE CMP Portal - Steering Management

1. CMP portal users can create and manage Steering Trees for all Providers supported by the platform.

2. MNO/Service Providers are able to decide which of the created Steering Trees are "default" for each provider (Only one "default" Steering Tree per provider will be supported).

3. MNO/Service Providers are also able to define additional Steering Trees. These Steering Trees will not be considered "default" and will be allocated to their customers (direct and indirect) based on Steering Trees Eligibility managed by the MNO/SP account.

4. When a customer is allocated with Steering Trees, CMP portal and Public API will allow this customer to change the Steering Tree for a specific IMSI.

5. Regardless of if Steering Tree modification action is allowed or not, customers in the system will be able to view the PLMN list included as part of a specific Steering Tree through CMP portal and Public API.

6. Billing-Based Steering can also be configured within the floLIVE CMP portal. Account users can create and manage billing Plans rules to control which countries and networks SIMs should connect to based on cost constraints. Real-time billing data is used to determine whether a device is allowed to connect to a network or not. This ensures optimized connectivity expenses while maintaining service quality.

Portal Overview

PROVIDER MANAGEMENT IN CMP PORTAL

STEERING TREE MANAGEMENT

STEERING TREES ALLOCATION TO AN IMSI

Conclusion

In a rapidly evolving IoT landscape, steering plays a critical role in ensuring devices maintain efficient and cost-effective connectivity. With the complexity and scale of global IoT deployments, solutions like floLIVE's steering platform provide the flexibility and customization necessary to meet diverse needs. The integration of advanced steering tree capabilities, along with SIM, core network, and billing-based steering options, gives IoT providers a powerful toolkit to optimize connectivity, control costs, and maximize network performance.

floLIVE's unique approach to steering differentiates it from traditional operators by prioritizing optimal service over purely commercial agreements. This allows businesses to gain the best possible value from their IoT deployments, ensuring uninterrupted, high-performance connectivity wherever their devices may be.

Let's Connect You to the World

About floLIVE

floLIVE designed and developed an elastic, robust core cellular infrastructure that is the largest connectivity backbone in the world. Through this powerful infrastructure, the company offers numerous services to mobile operators, IoT MVNOs and Global Enterprises seeking seamless, compliant, high performance and regulatory compliant connectivity, anywhere in the world.

With a global carrier library that is based on interconnected local core mobile networks, floLIVE ensures low latency, high performance, and full compliance with privacy acts, data regulations, and roaming restrictions. As of today, more than 20 mobile operators are on board the platform, giving companies multi-tier connectivity access.

Through direct access to our network, customers can monitor their devices, access real-time network events and usage, switch operators remotely, and troubleshoot failures ahead of time, providing a seamless experience that keeps devices connected at all times. Through one integration, one SKU and one platform, customers have a world of connectivity and endless possibilities.

Let's connect

Get in touch to discuss how we can meet your IoT requirements. We're sure to surprise you.

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