CISCO

Cisco Programmable Core

Transforming Mobile Infrastructure Into a Strategic Advantage
Through Radical Simplification.

Cisco® Programmable Core transforms mobile infrastructure into
a strategic competitive advantage through radical simplification.
Our comprehensive core-as-a-service solution eliminates the
complexity of multivendor integration while streamlining operations
and accelerating service deployment. This enables Communication
Service Providers (CSPs) to focus on what matters most: connecting
people, places, and things. Through simplified architecture and
enhanced programmability, CSPs can rapidly develop and deploy
innovative mobility services that drive new revenue streams.

Overview

CSPs are primed for growth, but technological complexity stands in their way. The challenge? Integrating multiple vendors across diverse technology generations, infrastructure platforms, delivery models, and upgrade cycles. This fragmentation dramatically increases the time, cost, and resources required to bring new services to market.

Enter Cisco Programmable Core – a solution inspired by modern hyperscaler platforms that prioritizes simplicity, affordability, and innovation. CSPs can now deploy services precisely aligned with their business needs while maintaining the flexibility to integrate their existing radio access, mobility, billing, and management systems through streamlined APIs.

Cisco's solution goes beyond basic infrastructure by providing a complete ecosystem that connects developers, CSPs, and end users. Developers can rapidly create new products and services to meet customer demands. CSPs can easily discover and deploy these services through a network application store. End users gain instant access to services through seamless platform orchestration.

This transformative approach enables CSPs to break free from legacy constraints. By embracing modern business models and technologies, they can focus on what matters most: creating innovative services, unlocking new revenue streams, and driving sustainable growth.
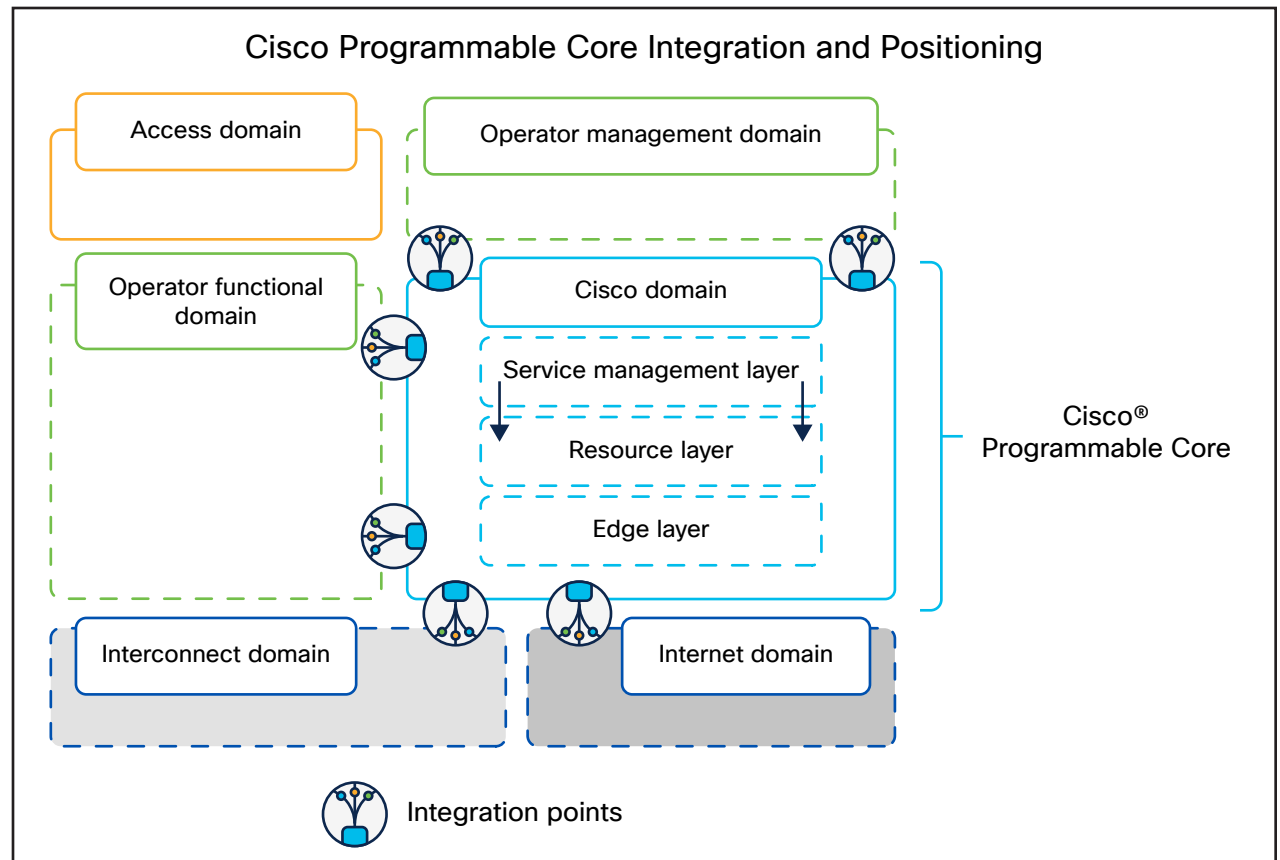

Figure 1.   Cisco Programmable Core framework

Key benefits of Cisco Programmable Core

- **Simplified operations through pre-integration:** A fully pre-integrated mobile core delivered as a service eliminates complex internal integration and operations, delivering significant cost and time savings for service providers.

- **Reduced complexity, enhanced innovation:** By abstracting away technical complexity, Programmable Core makes service creation and consumption straightforward, creating an environment where innovation can flourish.

- **Managed service excellence:** Cisco handles all maintenance responsibilities, including interoperability testing, solution validation, and seamless upgrades, helping ensure that your infrastructure stays current and optimized.

- **Freedom from legacy constraints:** Service providers can break free from heritage features and outdated systems, focusing investments on modern, profitable functionality without the burden of maintaining legacy infrastructure.

- **Accelerated service monetization:** Through the Cisco Mobility Services Platform, standardized APIs enable rapid development and deployment of new mobility services, creating faster paths to revenue (Figure 2).

- **Comprehensive mobility portfolio:** Cisco Programmable Core offers a full stack of mobility capabilities, encompassing all necessary network functions for both data, voice, and SMS services. This solution capitalizes on Cisco's extensive capabilities to provide an efficient and optimal core infrastructure for service delivery.
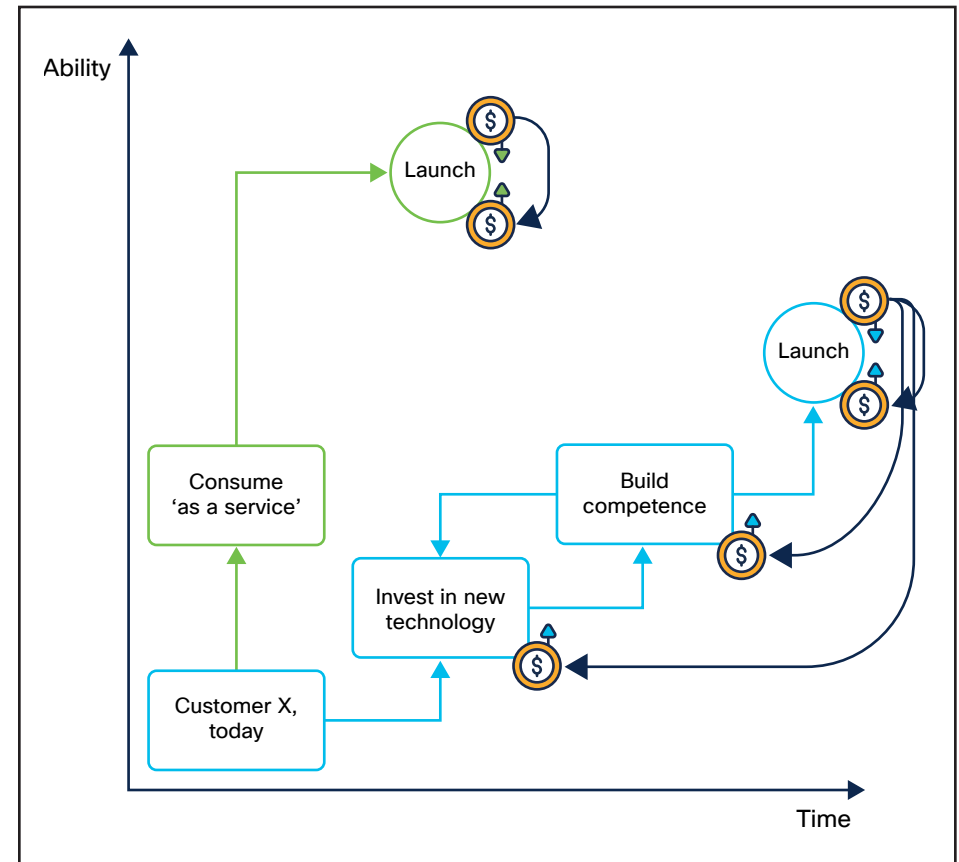

Figure 2. Accelerating service monetization through the Cisco Mobility Services Platform

Trends and challenges in mobile core operations

Service providers face mounting operational complexity in today's mobile networks.

Traditionally, each provider must independently manage the full lifecycle of thousands of network components across multiple vendors – from initial purchase and design to testing, deployment, and ongoing operations. This creates a massive operational burden, demanding significant investments in time, money, and expertise.

The challenge isn't static. Regular software updates, security patches, and functionality upgrades create a continuous cycle of integration and testing. This perpetual maintenance requires providers to maintain multiple lab environments, each with its own operational overhead and dedicated team.

The arrival of 5G has intensified these challenges. Each new 3GPP release introduces additional network functions to the mobile core, while the shift to microservices architecture has exponentially increased the number of

components requiring management. Service providers now face a critical imperative: finding new revenue streams to offset these escalating operational costs while managing ever-increasing network complexity.

The financial burden is equally significant. CSPs must make substantial upfront CapEx investments to build these networks – an additional strain on top of already hefty spectrum costs. Service providers now face a critical imperative: finding new revenue streams to offset these escalating operational and infrastructure costs while managing ever-increasing network complexity.
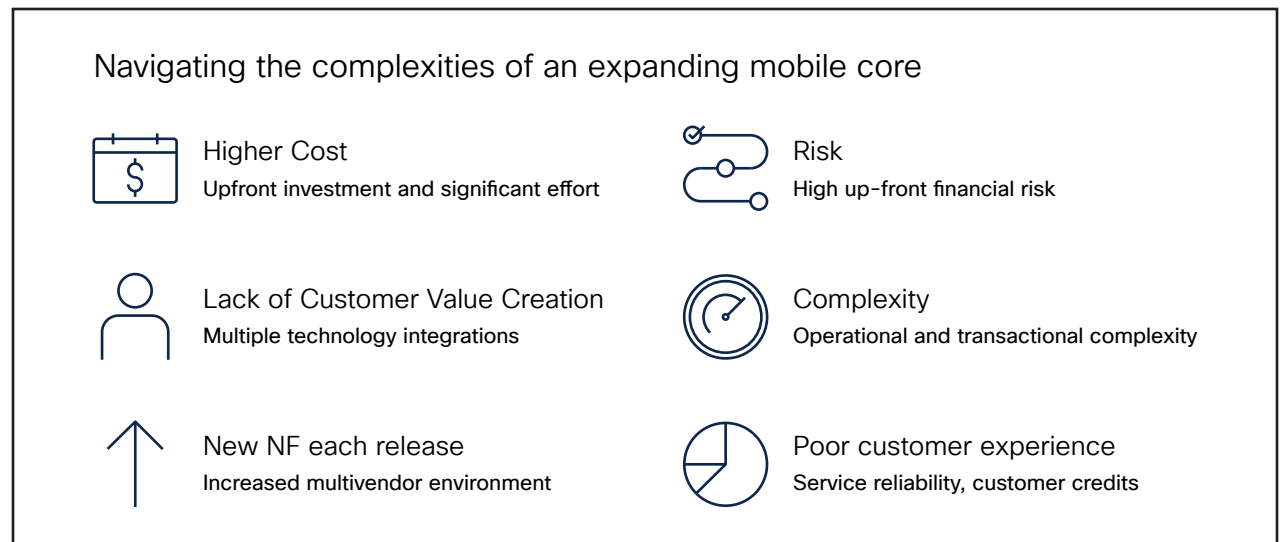
Navigating the complexities of an expanding mobile core

Higher Cost
Upfront investment and significant effort

Risk
High up-front financial risk

Lack of Customer Value Creation
Multiple technology integrations

Complexity
Operational and transactional complexity

New NF each release
Increased multivendor environment

Poor customer experience
Service reliability, customer credits

Figure 3.   Navigating the complexities of an expanding mobile core

How it works, key features, and components

Cisco Programmable Core is delivered through the Cisco Mobility Services Platform, offering ready-made and customizable templates for instant service activation. The platform's unified APIs simplify access to network assets by abstracting complex technologies, enabling streamlined:

- Network configuration

- Service activation

- Subscriber management

- SIM management

For detailed information, visit the Cisco Mobility Services Platform **website**.

Cisco's Programmable Core solution offers flexible deployment options in both public clouds and Cisco data centers. The cloud-agnostic architecture uses Cisco virtualization technologies that can run on either public cloud infrastructure or Cisco hardware, based on customer needs.

The solution supports edge data plane instances across multiple locations. While following a standard framework, the deployment architecture can be customized to each service provider's specific requirements.
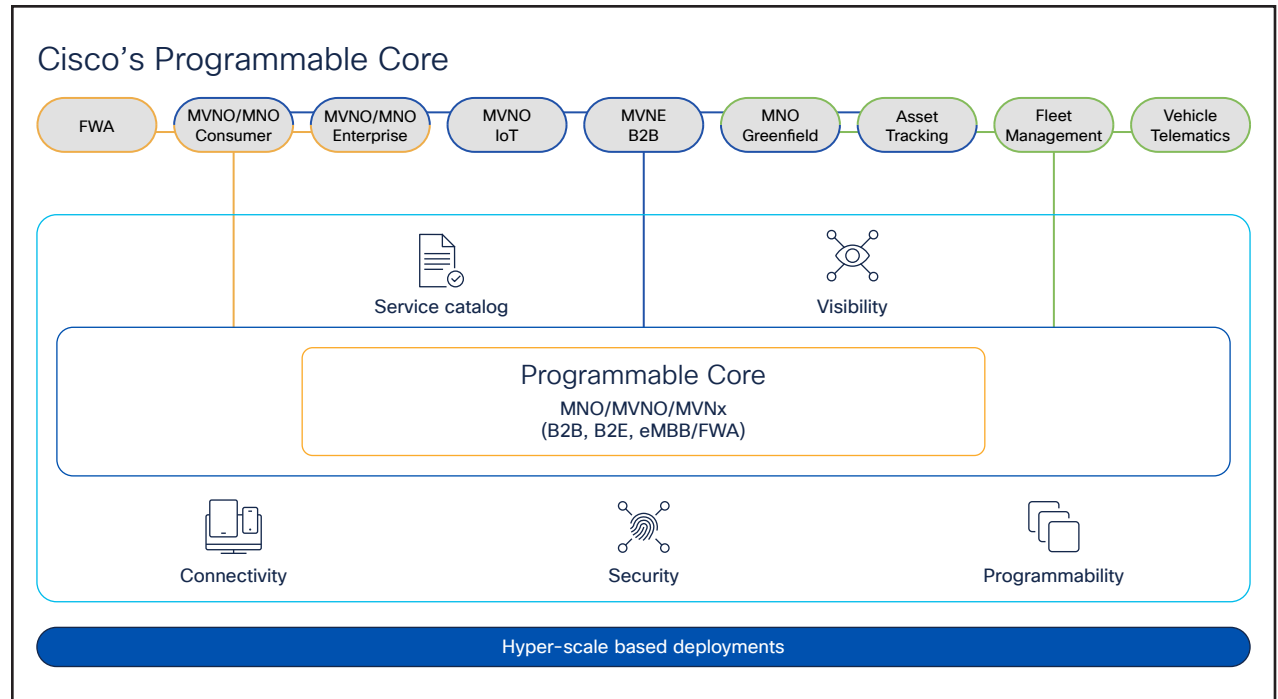

Figure 4.   Introducing Cisco Programmable Core

The optimal data center deployment model is determined by several factors:

- Network design requirements

- Desired cloud services

- Use case specifications

- Legal and compliance requirements

- Available infrastructure options (including public cloud, Cisco data centers, third-party colocation facilities, and service provider locations)

Central data centers

The central data centers for Programmable Core will be positioned such that latency and availability requirements can be met for the supported use cases. These locations house the management and control plane elements for the solution. Depending on the use case, if there is a control plane, and a user plane needs to be hosted in a colocated location, user plane capabilities can also be provided there.

Edge data centers

Edge data centers for user plane traffic can be supplied to accommodate latency, regulatory, or other requirements. The edge data centers can be deployed in a variety of locations, each of which has a different cost impact.

Redundancy scenarios

Cisco's Programmable Core features built-in high availability across all components and layers of the architecture. This is achieved through a combination of internal and external redundancies. For example, Cisco's service can be deployed across several data centers in different regions to protect against the loss or unreachability of a single data center and to protect against adverse weather or local infrastructure outages. Internally, each Network Function (NF) in the data center also has built-in
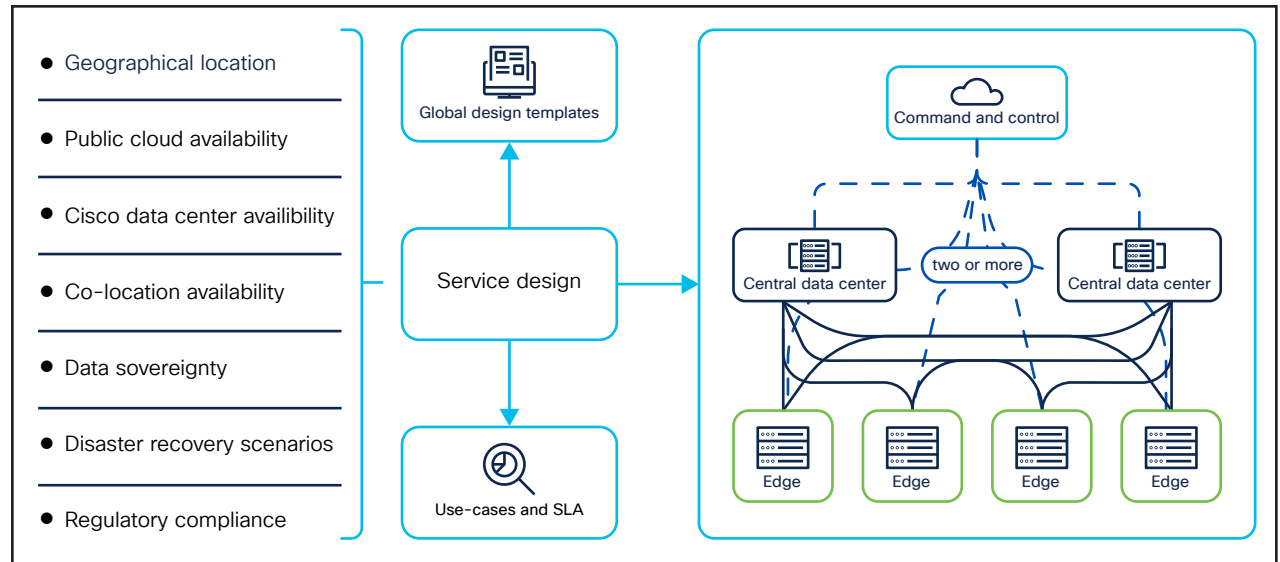

Figure 5.   Programmable Core data center deployment architecture

redundancy to protect against hardware and software failures. Additionally, rack-level redundancy is built in to handle a power failure to any rack. Overall, the solution is designed so that there is no single point of failure.

Externally, required redundancies are the responsibility of the service provider. For example, the service provider's Radio Access Network (RAN) must be able to support and be configured with multiple core destinations to handle instances in which a data center in Cisco's service is unavailable or unreachable. Another example is that the customer must provide redundant paths from the RAN to the core to protect against access and long-haul network problems.

Key capabilities

Cisco Programmable Core delivers a comprehensive mobile core network solution with advanced features beyond standard mobile services (data, voice, messaging), policy control, charging, and roaming support:

· **Service integration and automation**

  - Advanced API framework integrates seamlessly with carrier Business Support Systems (BSS)

  - Accelerates service creation and deployment through automated provisioning

  - Reduces time-to-market for new offerings

- **Universal access support**

  - Supports all mobile generations (2G/3G/4G/5G NSA/5G SA)
  - Enables Wi-Fi and satellite communications integration
  - Uses standard 3GPP interfaces for maximum compatibility

- **Enhanced service management**

  - Streamlines SIM card and subscriber lifecycle management
  - Provides developer APIs for access to network functionality
  - Offers a marketplace of prebuilt applications for rapid service deployment

- **Flexible business models**

  - Enables Mobile Virtual Network Operator (MVNO) connectivity with multiple host operators
  - Supports integration of enterprise authentication
  - Facilitates B2B service resale through multitenancy and network slicing

- **Regulatory compliance and security**

  - Integrates with lawful intercept systems
  - Supports emergency calling requirements
  - Provides inline services, including application detection and network address translation
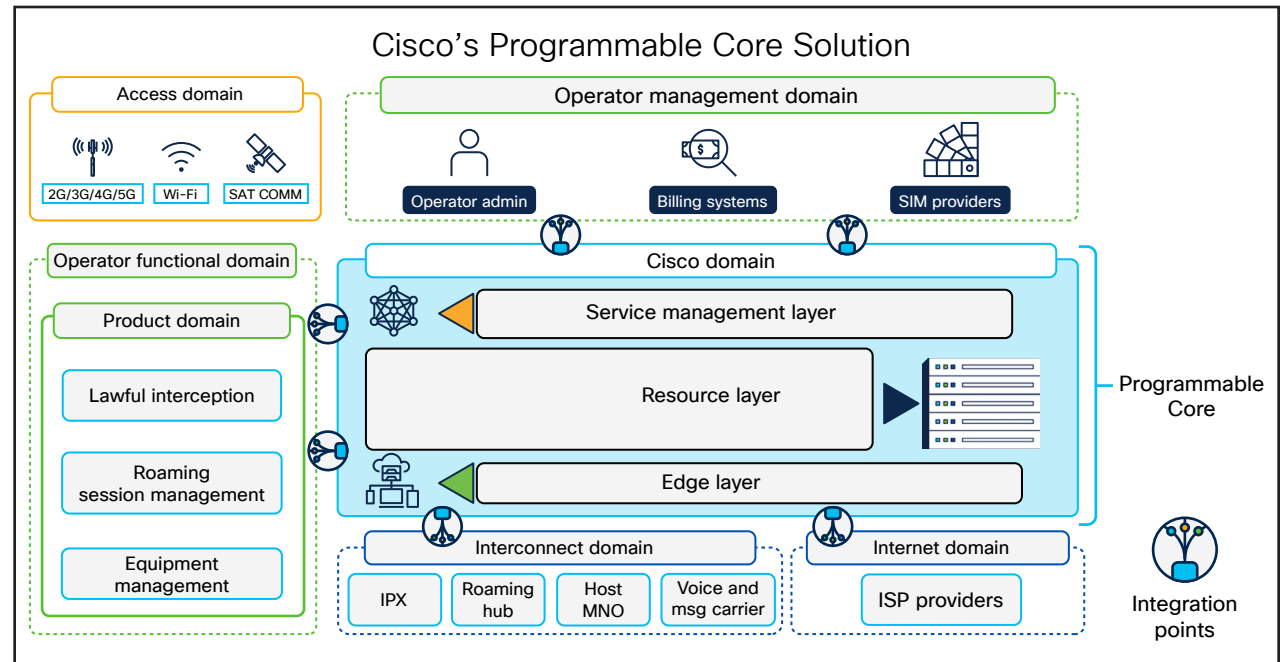

Figure 6.   Cisco's Programmable Core Solution

The Cisco Programmable Core solution integrates seamlessly with existing operator networks, allowing service providers to preserve their current infrastructure investments while launching new services. Its flexible architecture enables custom network configuration to meet specific operational requirements.

Our solution is structured into six key domains:

- **Cisco domain:** Serving as the heart of the solution, Programmable Core is organized into three layers: the service management layer, resource layer, and edge layer.

  - The service management layer abstracts the complexity and simplifies the core's configuration automation and network observability. It provides flexibility to integrate with the operator's BSS and SIM management ecosystems. This layer is essential for integration with the operator management domain.

- The resource layer is responsible for processing the business logic. Based on the services CSPs choose to offer, the service management layer will provision and configure the appropriate functionalities in this layer to effectively launch the services to their users.
- The edge layer handles the processing of data plane traffic and has been designed to be closer to the edge to handle the low-latency use cases.

· **Operator management domain:** This domain enables Programmable Core to connect and interact for provisioning, billing management, and integration with SIM providers via the service management layer.

· **Access domain:** This domain represents the variety of access technologies that are supported as part of Programmable Core.

· **Operator domain:** This domain allows CSPs to integrate their functions with Programmable Core. For example, lawful intercept or charging subsystem.

· **Interconnect domain:** Programmable Core offers interfaces that facilitate roaming use cases, connections with host Mobile Network Operators (MNOs), and integration with voice and messaging carriers.

· **Internet domain:** This domain includes standard service gateway interfaces that link Programmable Core to external data networks.

For customers who have existing partnerships with vendors for network functions, Cisco will collaborate to develop a mutually beneficial plan that meets all requirements.

Services offered and standard deployment models

Cisco Programmable Core provides customizable network services that can be deployed based on your business requirements. The platform integrates subsystems across multiple domains to support your selected services, as shown in the figure below.

The standard solution deployment model currently supports two scenarios:

· Virtual operator (MVNx) deployments and technology stacks

· Traditional mobile network operator deployments and technology stacks

Our core services include flexible capabilities that can be configured and licensed according to your needs. Feature packages vary by commercial offering (for example, Consumer Core versus IoT Core) and are available through different licensing options.

The Cisco Programmable Core standard model has three component types:

· Core network components (blue): Owned and managed by Cisco
· Operator components (green): Owned and managed by network operators
· Flexible components (yellow): Including mobility management, charging management, and Wi-Fi integration services, which can be hosted and managed by either Cisco or the operator, as agreed upon

This standard model is our recommended solution, as it offers:

· Faster time to market
· Enhanced service delivery
· Streamlined operations
· Cost savings
· Innovation opportunities

The platform enables integration between Cisco and operator domains through:

· Northbound interfaces for provisioning, BSS, APIs, and UI/UX
· Southbound interfaces for roaming functionality

Cisco Programmable Core supports:

· Infrastructure sharing for MVNOs and MNOs
· Rapid deployment of new and supplementary services
· B2C and B2B enterprise solutions without management overhead or interoperability issues

Market-leading programmability

Cisco Programmable Core includes the Mobility Services Platform Digital Suite and the Developer Ecosystem. These offerings provide modular and integrated solutions for service providers and enterprises.

The Digital Services Suite enhances service deployment with API-driven programmability, enabling low-cost, low-touch service creation and management. It supports a wide range of use cases, including self-service subscription management, leveraging over a decade of proven IoT service and device management features as well as programmability solutions for mobile packet core sessions, quality-of-service policy, and session charging.

The Developer Ecosystem fosters innovation by engaging third-party developers through a dedicated portal and marketplace. This ecosystem allows developers to create and publish apps, offering service providers and enterprises new, pre-integrated solutions to accelerate time to market and revenue. Service providers should expect to see products in security, collaboration, location, IoT, AI voice agents, and similar areas in the app store.

Together, these components help service providers and enterprises accelerate revenue generation through simplified service deployment, network automation, and new monetization opportunities.
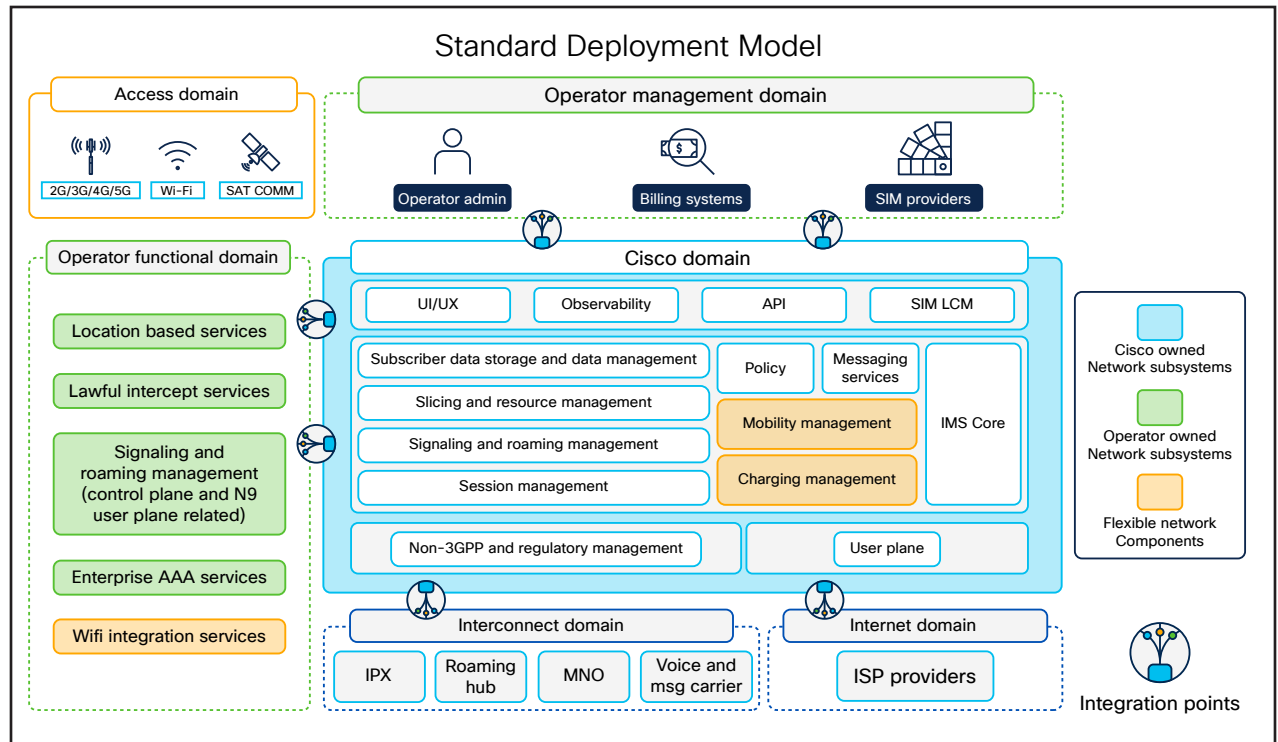

Figure 7.   Programmable Core standard deployment model

Roles and responsibilities

Cisco provides the expertise and resources necessary for interconnecting the main network elements relevant to service delivery. Meanwhile, the customer is responsible for supplying the necessary partner agreements and ensuring engagement and resource allocation from partners to support service integration. These partners include service providers (EPC/RAN), SIM/eSIM profile vendors, device OEM agreements for carrier bundles (iOS/Android), BSS, IPX, roaming hub, ISP, voice carrier, messaging carrier, transit network, laboratory information management systems, and Mobile Number Portability.

Security

Security in Cisco Programmable Core is a fundamental aspect of the solution's design. We have established processes to monitor our cloud and application infrastructure and promptly address identified vulnerabilities.

Additionally, the solution is governed by Cisco's Secure Development Lifecycle framework, which includes annual reviews and updates in collaboration with the Cisco Security and Trust Organization.

The solution benefits from the extensive Cisco Security portfolio, alongside more than 180 partnerships with industry players and open-source communities. It also leverages the capabilities of the largest private threat intelligence and research team in the world, Cisco Talos®, which provides unparalleled visibility across the threat landscape and reduces the time required to detect and resolve security issues.

Operational visibility – Fault and performance management

Cisco provides different layers of tools to the service provider for troubleshooting problems and monitoring the overall performance of the solution. The intent is to provide a curated set of not just data, but information to enable customers to understand service performance and manage end customers quickly and easily. Some of the key capabilities provided are:

- Network dashboards: Overall service health, including interface performance, capacity statistics, service alerts, and maintenance events.

- Diagnostic tools: Intuitive diagnostic tools to quickly identify, isolate, and fix unusual service behavior.

Programmable Core operational details

Service provisioning and management

Cisco makes available open APIs for exposure of a rich set of service personalization and operational visibility of the solution, with next-generation API solutions based on a dynamic and modern service catalog for API integration model in line with TM Forum API principles and specifications.

Further, these APIs are accompanied/enriched by select GUI capabilities.

Some of the key features of service provisioning and management are:

- Lifecycle automation
- Network provisioning
- Service plan creation
- Subscriber operations
- Usage management

Data Services

- Private APN Enterprise
- Data Access 2G/3G, 4G, 5G
- Deep Packet Inspection
- Network Address Translation

Voice, Supplementary, Barring Services

- Voice – CS, LTE, NR, WiFi
- Voice Mail/Announcement
- SRVCC Rel 8/Pre Rel 9
- Missed Call Notification
- Call Forking
- VoLTE Conference Call
- Multi Call
- XCAP
- CLIP, CLIR,CFU, CFNR, CFNRc, CW, CH
- BAIC, BAOC, BOIC, BOIC-exHC, OBOPRE/I,BWR

Messaging Services

- SMS
- MMS

Priority Services

- Emergency Calls
- Emergency Call Vo WiFi

Roaming Services

- National and International Roaming
- Multi SIM/Multi IMSI

Integration Services

- Regulatory LI
- Location
- Mobile Number Portability
- EIR

WiFi Services

- 2G/3G/4G WiFi
- 5G WiFi (N3IWF Integration)
- OpenRoaming Alliance

Charging Services

- 4G Realtime Charging
- 4G Offline Charging – CDR Based
- 5G Realtime Charging

Management Services

- Subscriber LCM UI/UX
- API EcoSystem
- Observability – Splunk
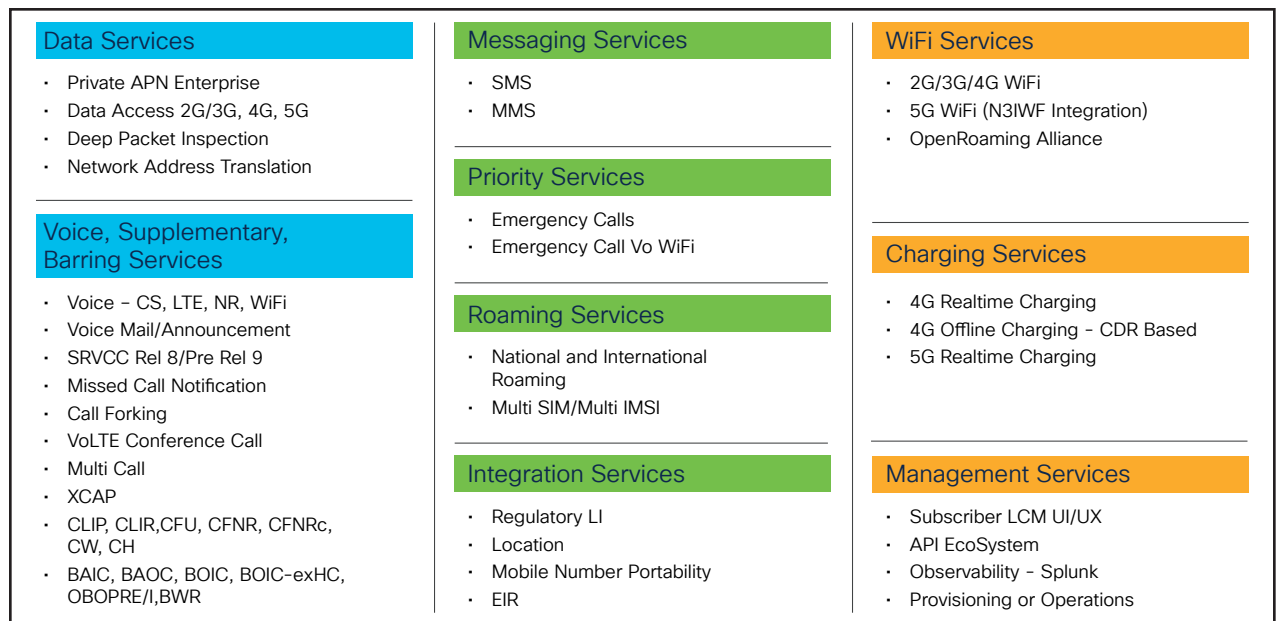- Provisioning or Operations

Figure 8.   Programmable Core feature packs

Market leading programmability - API Driven and Developer Ecosystem

Integration Flexibility - Flexible enough to be integrated with existing deployed network components

Mobility Core and Service Management Layer - Industry-leading 4G/5G converged mobility core and Service Management Layer

Multigenerational Access and Services Support - Supporting 2G,3G,4G, 5G Technologies

Use cases

Cisco Programmable Core empowers CSPs to fulfill their commitment to connecting people by equipping them with the capability to offer an extensive array of mobility services to their subscribers.

Table 1.   Programmable Core use cases by industry

Programmable Core targeted industry	Use cases
MVNx	• Full MVNO: Core network for consumer MVNOs • Full MVNO: Core network for enterprise MVNOs • Full MVNE: Core network platform for MVNx platforms • IoT MVNO: Core network for customers with their own connectivity management platform
MNO	• MVNE: Core for wholesale departments • Consumer Core: For internal MVNOs, expansion use cases, and similar • Enterprise Core: For solving complex enterprise use cases • IoT Core: For connecting with an existing third-party/MNO connectivity management platform; alternatively, Cisco also has a bundled offering with the Cisco IoT Control Center connectivity management platform. • Fixed Wireless Access

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Learn more

Cisco Programmable Core enables MNOs to rapidly deploy 5G services with minimal risk and investment, accelerating revenue generation and customer value.

- To learn more about the Cisco Mobility Services Platform, visit the platform's website.

- To learn more about Cisco Converged Core, see this white paper.

- To schedule a demonstration of the Cisco Mobility Services Platform, contact your Cisco sales representative.

The Cisco Advantage

Cisco's proven expertise in as-a-service delivery spans multiple domains:

In IoT, our IoT-as-a-service platform currently manages over 250 million devices and processes 130 million daily API calls, earning Frost and Sullivan's 2024 Company of the Year Award. In consumer mobility, our partnership with T-Mobile delivered the industry's first cloud-native 5G core gateway, now handling over 200 million sessions on our Converged Core Platform. Globally, Cisco mobility products serve more than 1 billion connections.

Our industry leadership extends beyond connectivity. Through our Splunk® AI solutions, we deliver industry-leading security capabilities, while our comprehensive portfolio of mobility network components provides end-to-end infrastructure solutions.

For CSPs seeking to modernize their networks, Cisco offers a unique advantage: access to our complete technology stack, eliminating both hefty upfront investments and complex system integration challenges and enabling rapid, efficient network transformation.