Connecting ideas, anticipating the future:
collaborative innovation for 5G and 6G networks.

II INTERNATIONAL WORKSHOP
xGMobile

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xGMobile Centro de Competência EMBRAPII Inatel em Redes 5G e 6G

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MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÃO

GOVERNO DO BRASIL
DO LADO DO POVO BRASILEIRO

Enhancing 5G Core Services through Open Gateway

Cristiano Bonato Both

UNISINOS

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Cristiano Bonato Both

- Full professor in the Applied Computing Graduate Program at the University of Vale do Rio dos Sinos (UNISINOS)
- **Coordinator of the project "*A New Minimum Common Base for NovaGenesis and NSaaS: Advancing Cyber-Physical Infrastructures with Blockchain and AI Functions*" of *xGMobile***
- Research interests:
  - Computer Networks and Telecommunication
  - Mobile technologies (RAN, transport, and core)
  - Software-Defined Networking (SDN)
  - Network Functions Virtualization (NFV)
  - Mobile Edge Computing (MEC)
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Agenda

- New mobile network capabilities
- Historical evolution of 5G core
  - Service-based architecture
  - Network exposure function
- Open Gateway interface
  - GSMA
  - Camara Project
- Use cases
  - Open-source
  - Brasil operator

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New mobile network capabilities

- Operators will not survive by selling only the transmission of bits
- They need to offer new services using the information they have about their customers and your network infrastructure

How and where can Telcos innovate?

How can this be done?

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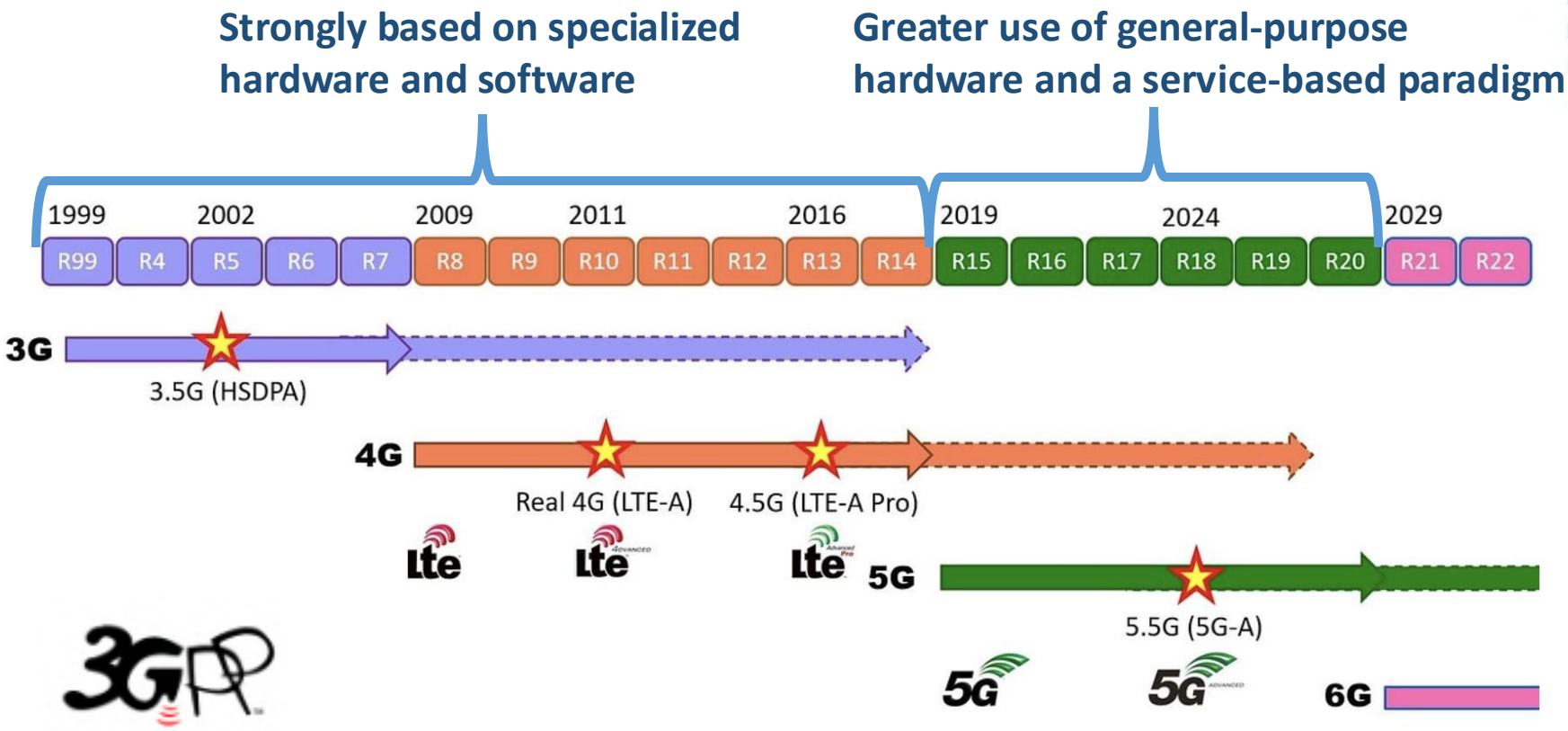
Historical evolution of 5G core



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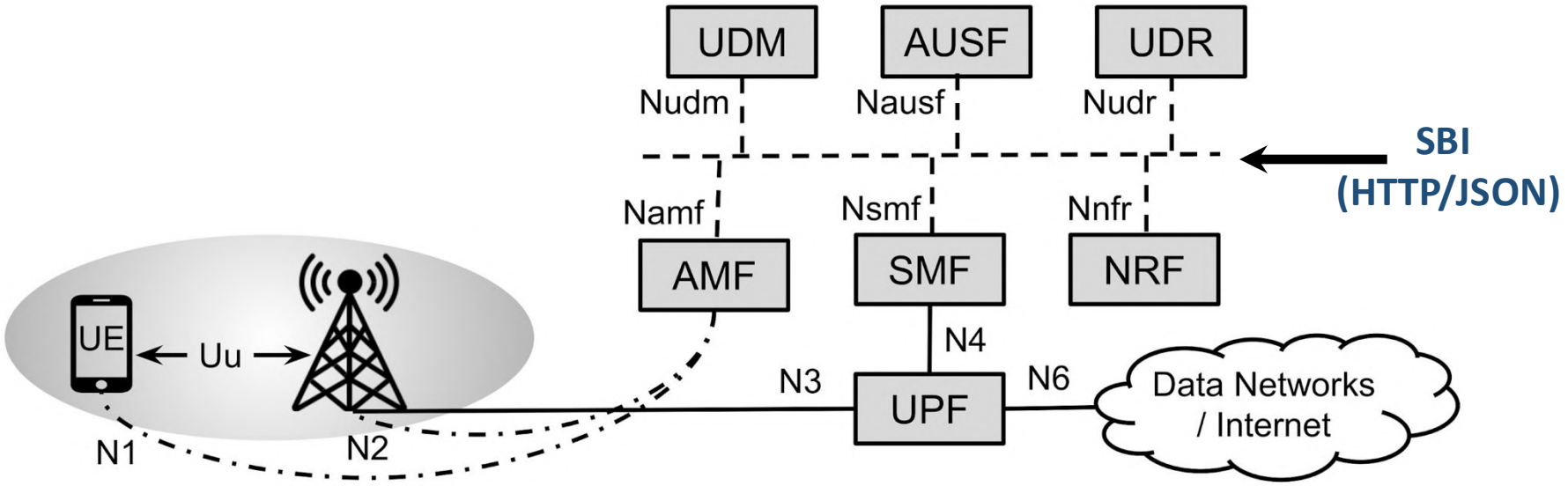
Service-based architecture

- From Release 15, the 5G core is based on service
- RAN follows the same approach, considering the O-RAN alliance

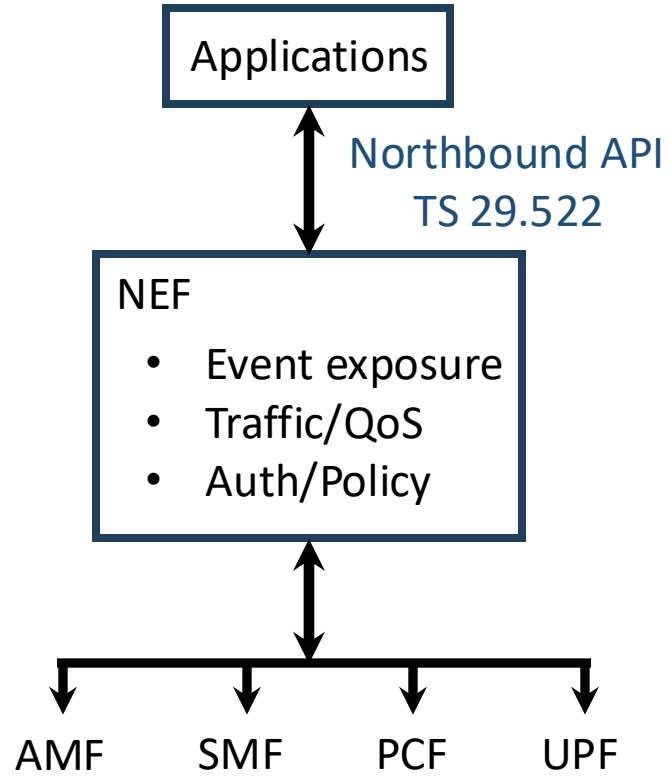


Network exposure function

- Exposing the internal capabilities of the mobile operators as new services to third parties
- A NEF access interface opens, creating new business opportunities for service mobile operators
- The benefits of NEF are also to optimize resource allocation and improve network efficiency

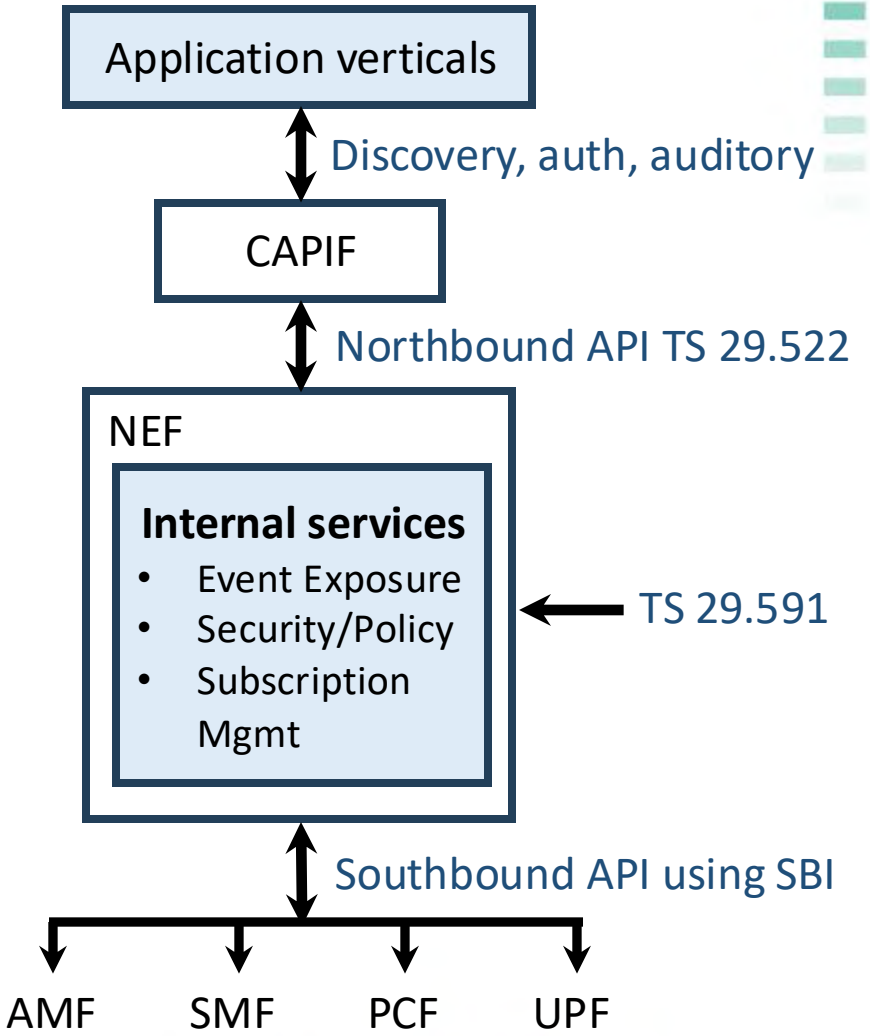
Network exposure function

- **Release 15 (Introduction)**
  - NEF was introduced as a core element of the 5G architecture, oriented to events
  - Provides *secure, controlled, standardized* exposure of network capabilities
  - Define the **network northbound exposure (Nnef)** for the 5G core



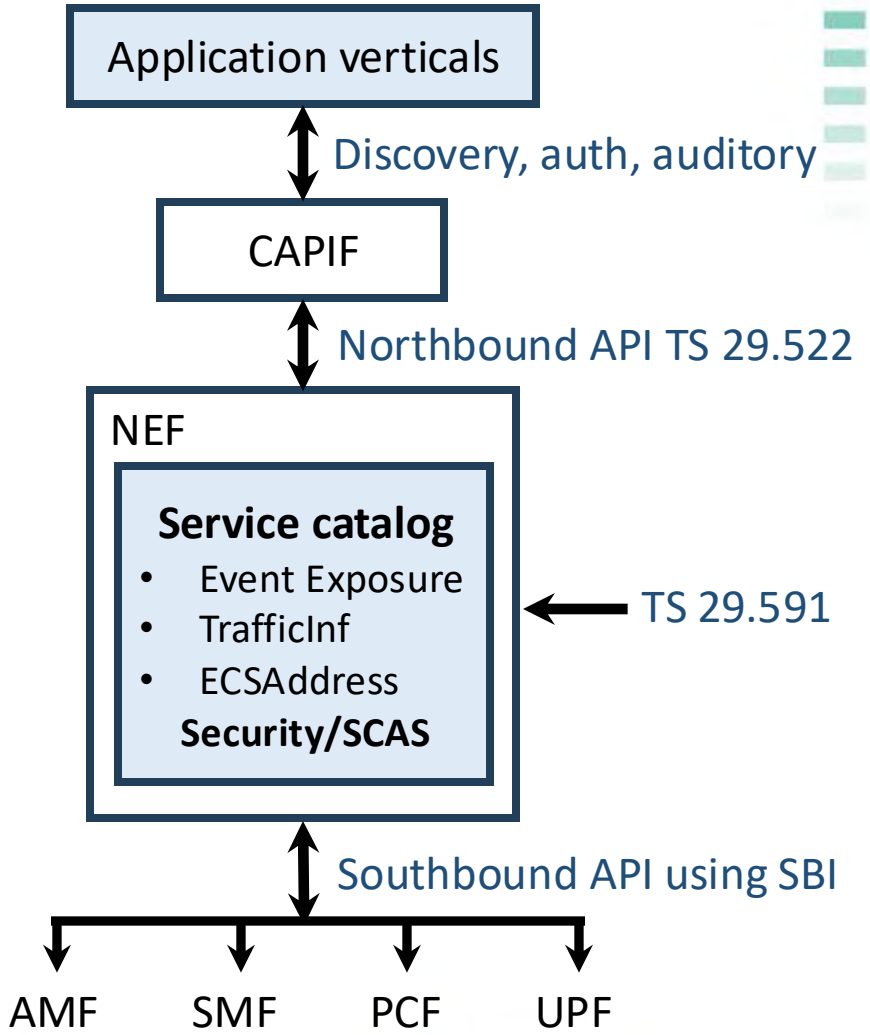
Network exposure function

- **Release 16 (Expansion)**
  - Introduce the Common API Framework (CAPIF) for exposing functions to discovery, authorization, and auditing
  - Enhance the **NEF southbound services**, formalizing Nnef_Event Exposure using Subscribe and Notify for architecture, operation, and data model
- **Release 17 (Expansion)**
  - Non-new internal blocks
  - Introduce Application Enabler Layer APIs
    - Service Enabler Architecture Layer (SEAL) for Verticals – EdgeApp, V2Xapp, etc.

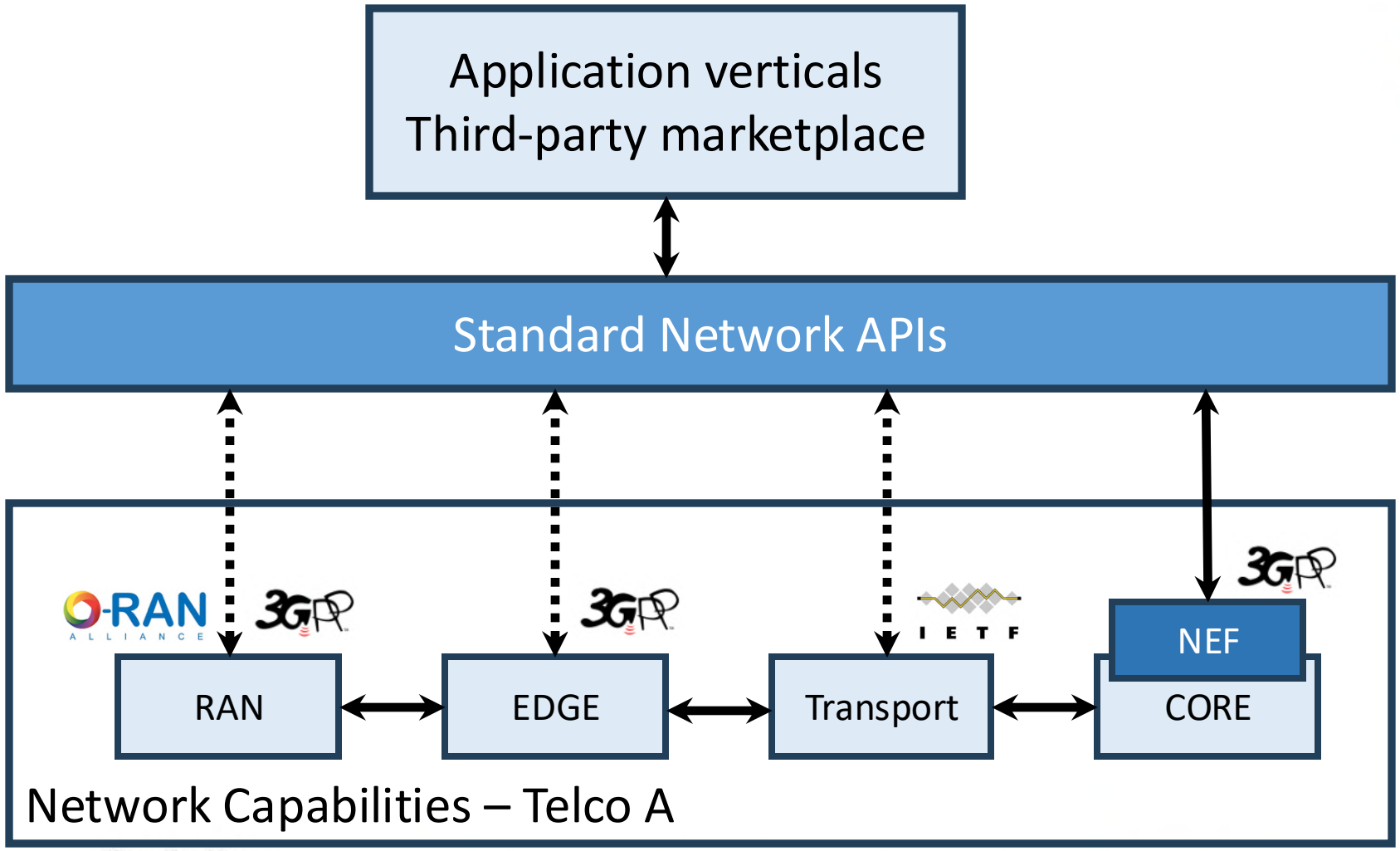


Network exposure function

- **Release 18 and 19 (5G advanced)**
  - New services – NEF as a **service catalog** for exposure
    - Traffic Influence Data, Edge Computing Service address, Data Network Access Identifier mapping, etc.
  - New capabilities for use cases – Energy, resource allocation efficiency, sustainability, Ambient Internet of Things (A-IoT)
  - Enhance as a Security Assurance Specification (SCAS) – TLS and validation of the Application functions



Network exposure function



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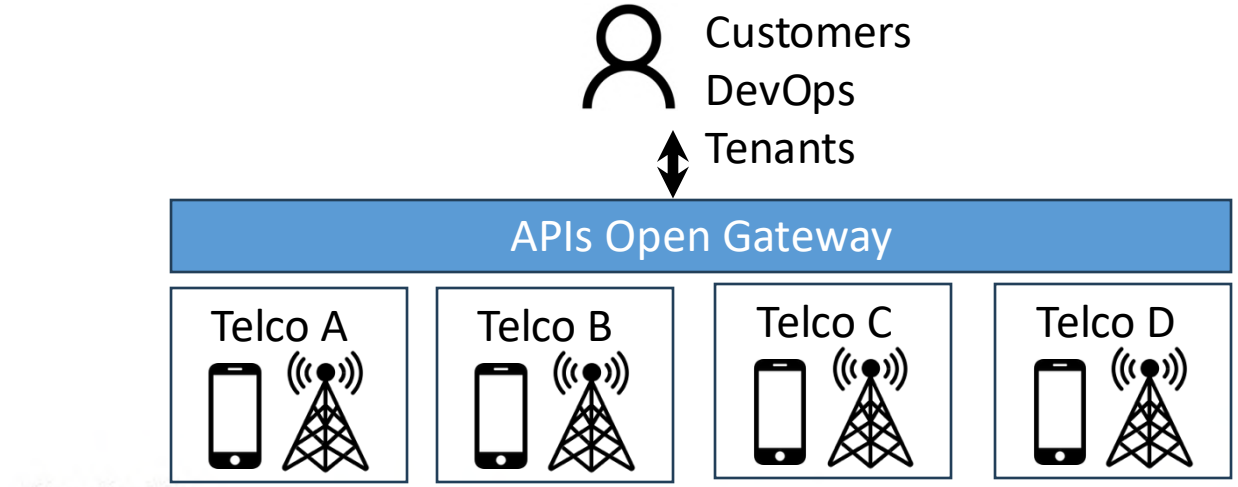
Open Gateway interface

- NEF was designed to expose the capabilities of **a single operator**
- Customers, DevOps teams, tenants, and so on need to access these capabilities across **multiple operators**
  - For example, a fintech may want to verify a customer's authenticity regardless of which operator they use

How can this be achieved?



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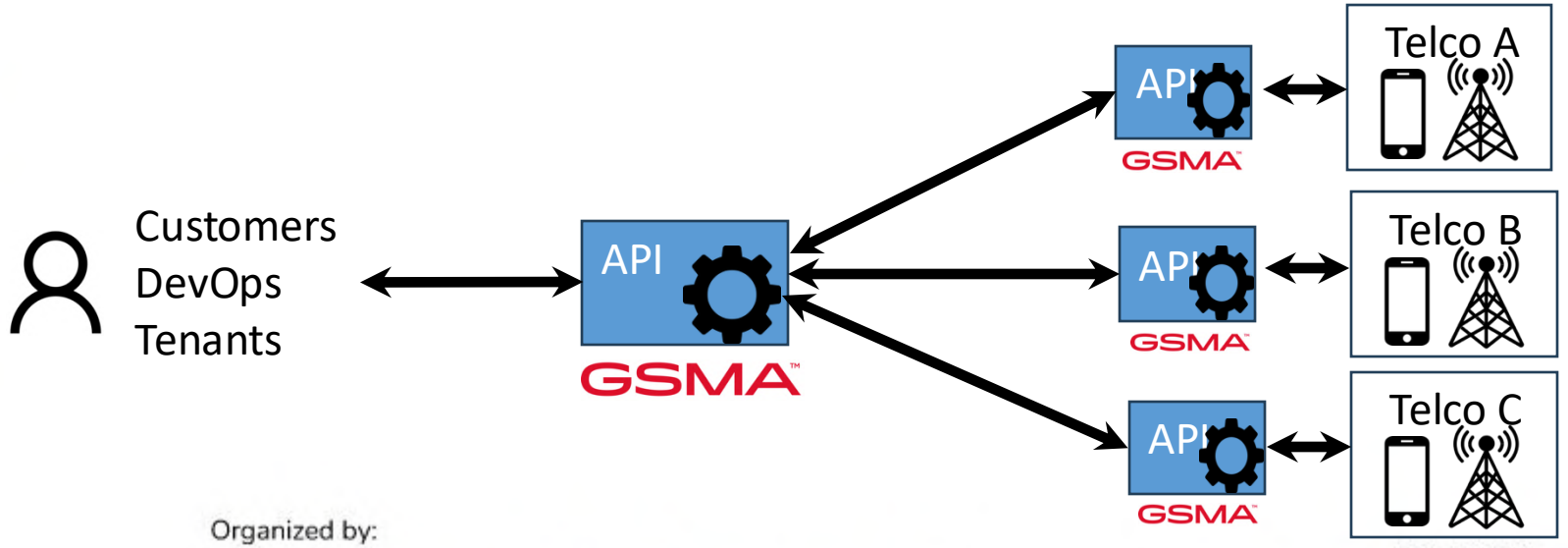
Open Gateway interface

- Open Gateway is a GSMA global initiative that enables mobile networks to function as open platforms, making telecom capabilities accessible to developers
- It focuses on **simple integration**, **clear and consistent interfaces**, **straightforward coding**, **strong privacy and consent controls**, and a broad portfolio of standardized APIs



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CAMARA project

https://camaraproject.org/
https://github.com/camaraproject

- The CAMARA project is an open-source initiative hosted by the **Linux Foundation** in partnership with the GSMA
- Its purpose is to drive the creation, evolution, and testing of user-facing APIs

APIs Catalog

- Communications
- Connectivity
- Identity
- Payments
- Fraud

(1)(2)	API Name	Fall25 Version	Spring25 Version	Fall24 Version	Repository
Stable CAMARA APIs	device-reachability-status	1.1.0	1.0.0	0.6.1	DeviceReachabilityStatus
	device-roaming-status	1.1.0	1.0.0	0.6.1	DeviceRoamingStatus
	location-verification	3.0.0	2.0.0	1.0.0	DeviceLocation
	number-verification	2.1.0	2.0.0	1.0.0	NumberVerification
	one-time-password-sms	1.1.1	1.1.0	1.0.0	OTPValidation
	qos-profiles	1.1.0	1.0.0	0.11.1	QualityOnDemand
	quality-on-demand	1.1.0	1.0.0	0.11.1	QualityOnDemand
	sim-swap	2.1.0	2.0.0	1.0.0	SimSwap
	simple-edge-discovery	2.0.0	-	1.0.0	SimpleEdgeDiscovery
	device-swap	1.0.0	0.2.0	-	DeviceSwap

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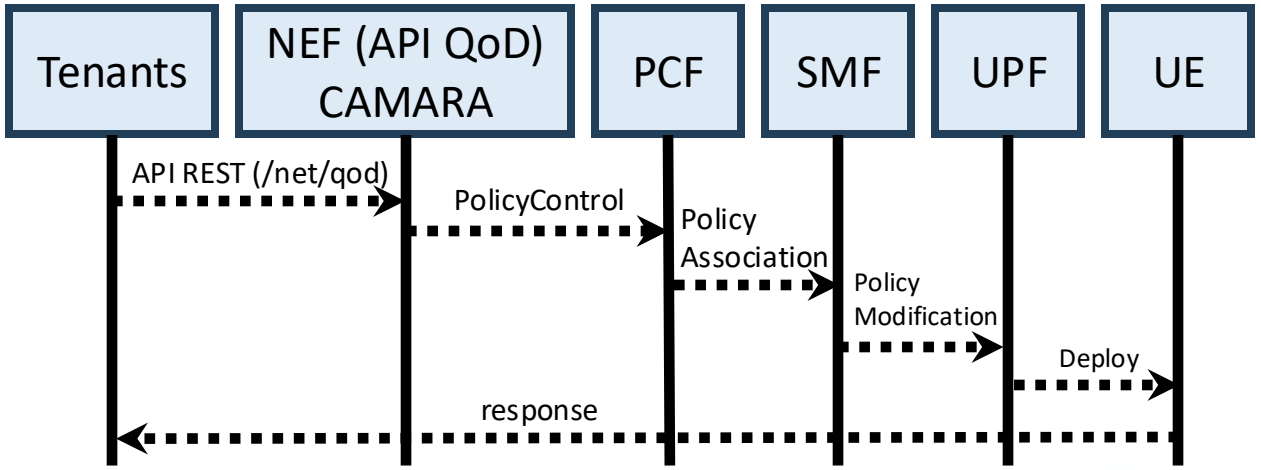
Use cases – Open-source

- Quality on Demand (QoD) based on the free5GC project
- **External applications can request on-demand QoS** adjustments according to their immediate needs
- Implementation using the Go language and RESTful API
- We integrated and updated the functions: PCF, SMF, and UPF



https://github.com/camaraproject/QualityOnDemand/blob/r3.2/code/API_definitions/quality-on-demand.yaml

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Use cases – Open-source

EndPoint request /qod/v1/sessions

```
{
  "device": {
    "networkAccessIdentifier": "123456789@domain.com"
  },
  "applicationServer": {
    "ipv4Address": "192.168.0.1/24",
    "ipv6Address": "2001:db8:85a3:8d3:1319:8a2e:370:73"
  },
  "devicePorts": {
    "ranges": [
      {
        "from": 0,
        "to": 6000
      }
    ]
  },
  "duration": 86400,
  "qosProfile": "QCI_1_voice"
}
```

EndPoint response /qod/v1/sessions

```
{
  "device": {
    "phoneNumber": "123456789",
    "networkAccessIdentifier": "123456789@domain.com",
    "ipv6Address": "2001:db8:85a3:8d3:1319:8a2e:370:7344"
  },
  "applicationServer": {
    "ipv4Address": "192.168.0.1/24",
    "ipv6Address": "2001:db8:85a3:8d3:1319:8a2e:370:7344"
  },
  "devicePorts": {
    ...
  },
  "qosProfile": "QCI_1_voice",
  "webhook": {
    ...
  },
  "sessionId": "3fa85f64-5717-4562-b3fc-2c963f66afa6",
  "duration": 86400,
  "startedAt": 1639479600,
  "expiresAt": 1639566000,
  "qosStatus": "REQUESTED",
  "messages": [
    ...
  ]
}
```

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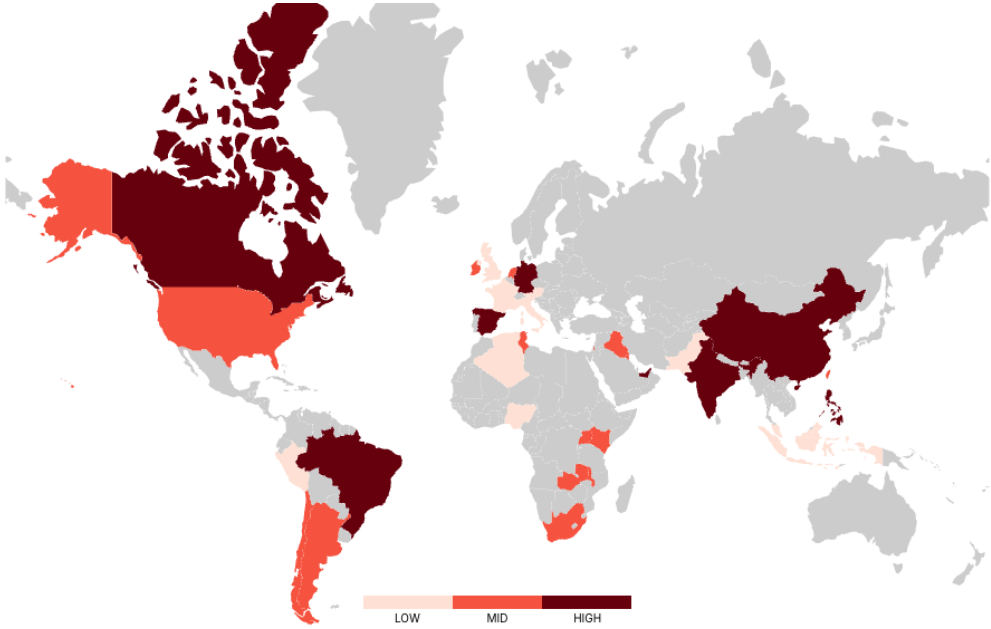
Use cases – Brazilian operator

- Brazil is one of the pioneers in the use of Open Gateway APIs



API'S DEPLOYED (158)

Markets	Channel Partner	Provider	API Name	Auth Flows	Version	Certified
Brazil	Infobip	Claro (America Movil)	Number Verification - Phone number verify	AC	0.3.1	GSMA API Certified
Brazil	Infobip	Claro (America Movil)	Number Verification - Phone number share	AC	0.3.1	GSMA API Certified
Brazil	Infobip	Claro (America Movil)	SIM Swap - Check	CC	0.4.0	GSMA API Certified
Brazil	Infobip	Claro (America Movil)	SIM Swap - Retrieve Date	CC	0.4.0	GSMA API Certified

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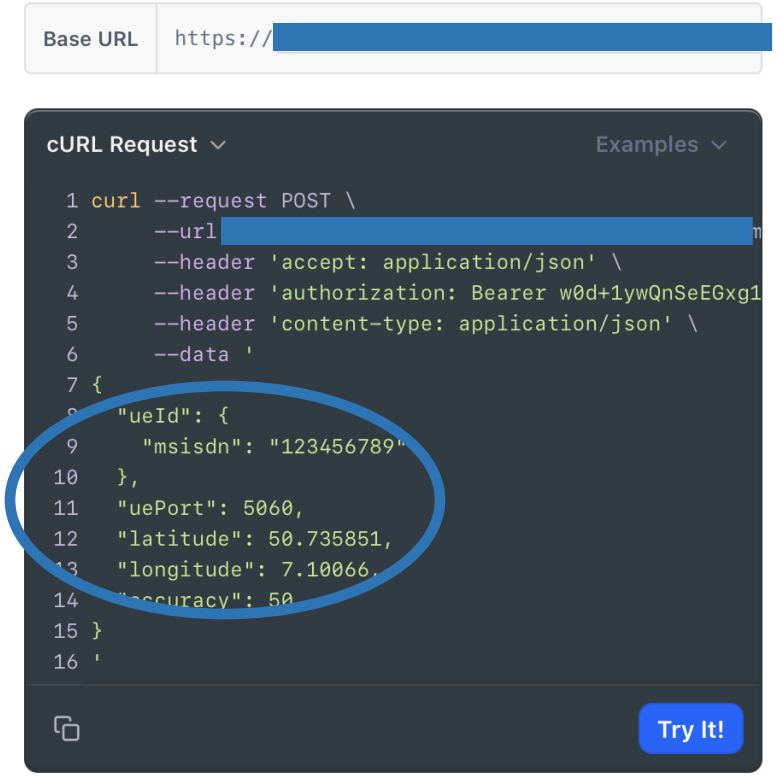
Use cases – Brazilian operator

- We tested APIs available for a Brazilian operator
  - Number Verification
  - SIM Swap
  - Device Location
- Fintech companies are very interested in these services to prevent fraud
- The services are still in a testing phase, with many opportunities for improvement



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Marketing

Tutorial 3
From Static Slicing to Network Slicing as a Service: The Evolution of 5G Network Customization

November 27th – Thursday
Afternoon – 3:30h to 5:30h

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Thank you!!

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