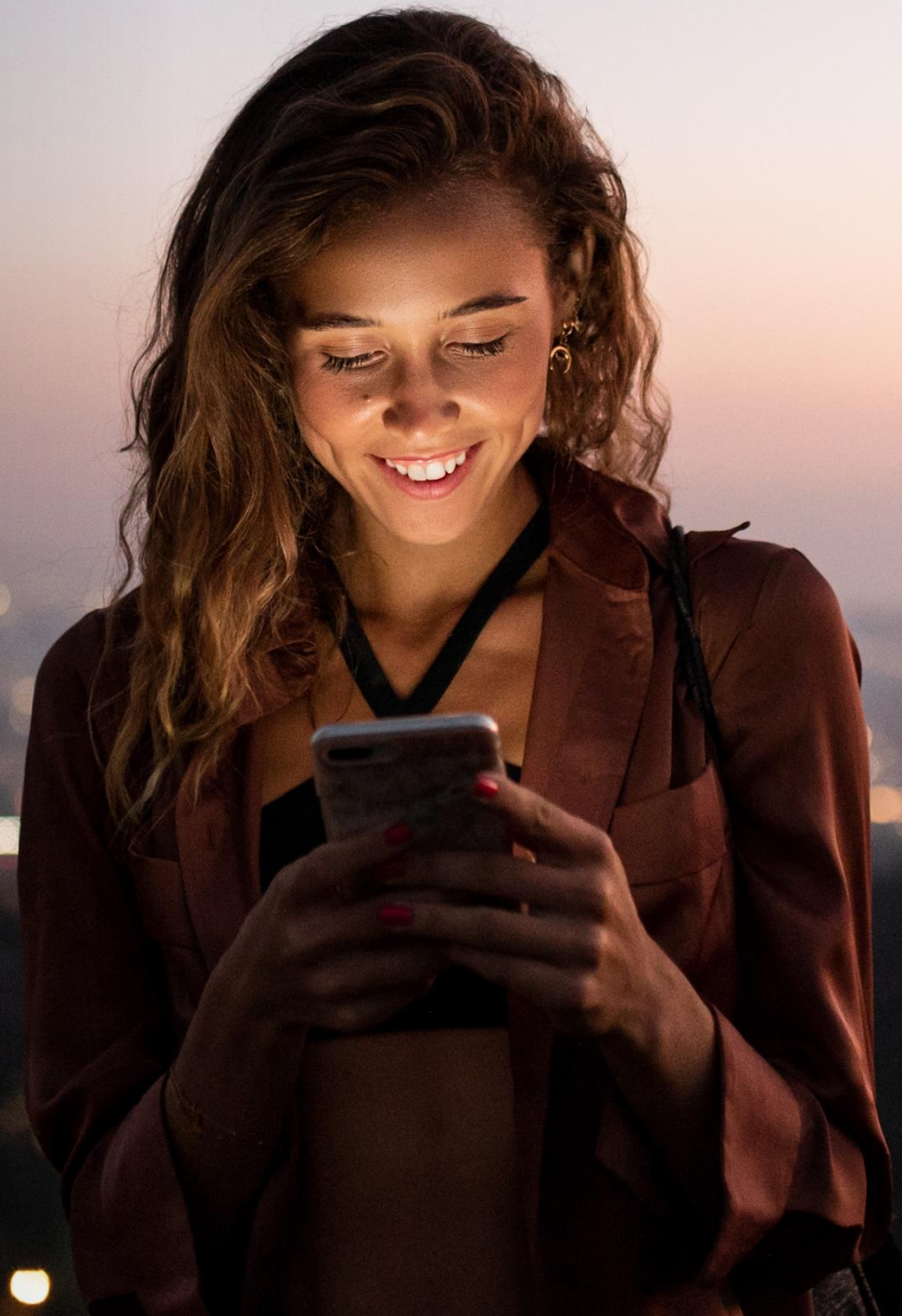# 5G Roaming

Journey so far & Challenges ahead

Pradeep Bhardwaj
Sr Strategy Director – Head of Industry Standards

syniverse®

5G Deployments

Operators have been deploying 5G Non-standalone across the world but are now looking to deploy 5G SA; uptake of 5G devices/services continues to grow

5G deployments are accelerating

- 588 operators in 176 countries and territories are investing in 5G

- 308 operators in 118 countries and territories have launched commercial 5G services

- 124 operators in 58 countries are investing in public 5G SA networks

- At least 49 operators in 29 countries and territories have launched/deployed public 5G SA networks

- 336 operators investing in VoLTE in 149 countries and territories.
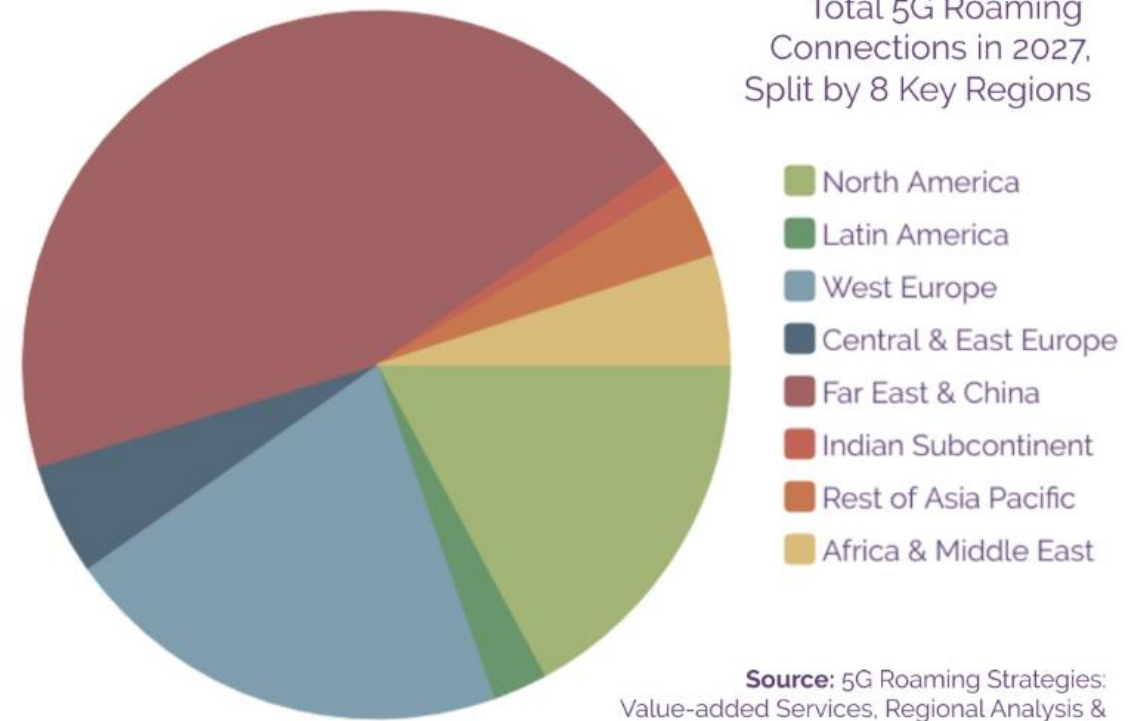
Source: gsacom.com

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5G Uptake in India

India has seen a significant growth in 5G coverage and subscriptions

5G availability in India improved from 28.1% in Q1 to 52.0% in Q4 2023, representing a 23.9 percentage point increase within a year [Source: Ookla]

5G subscriptions in India estimated around 130 million in 2023, and expected to grow to 860 million by 2029 [Source: Ericsson]

Total number of 5G global roaming connections will surge 900% in 4 years, from 52.5million in 2023 to 526 million by 2027 [Source: Juniper Research]


Total 5G Roaming Connections in 2027, Split by 8 Key Regions

- North America
- Latin America
- West Europe
- Central & East Europe
- Far East & China
- Indian Subcontinent
- Rest of Asia Pacific
- Africa & Middle East

Source: 5G Roaming Strategies: Value-added Services, Regional Analysis & Market Forecasts 2023-2027 [Juniper Research]

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Operator Considerations

Things to consider for launching 5G and 5G SA

Licence, Spectrum	Network	Coverage
Capacity	Devices	Billing
Security	Interconnection	Roaming
VAS	Applications, Services & Use cases	Testing & Rollout
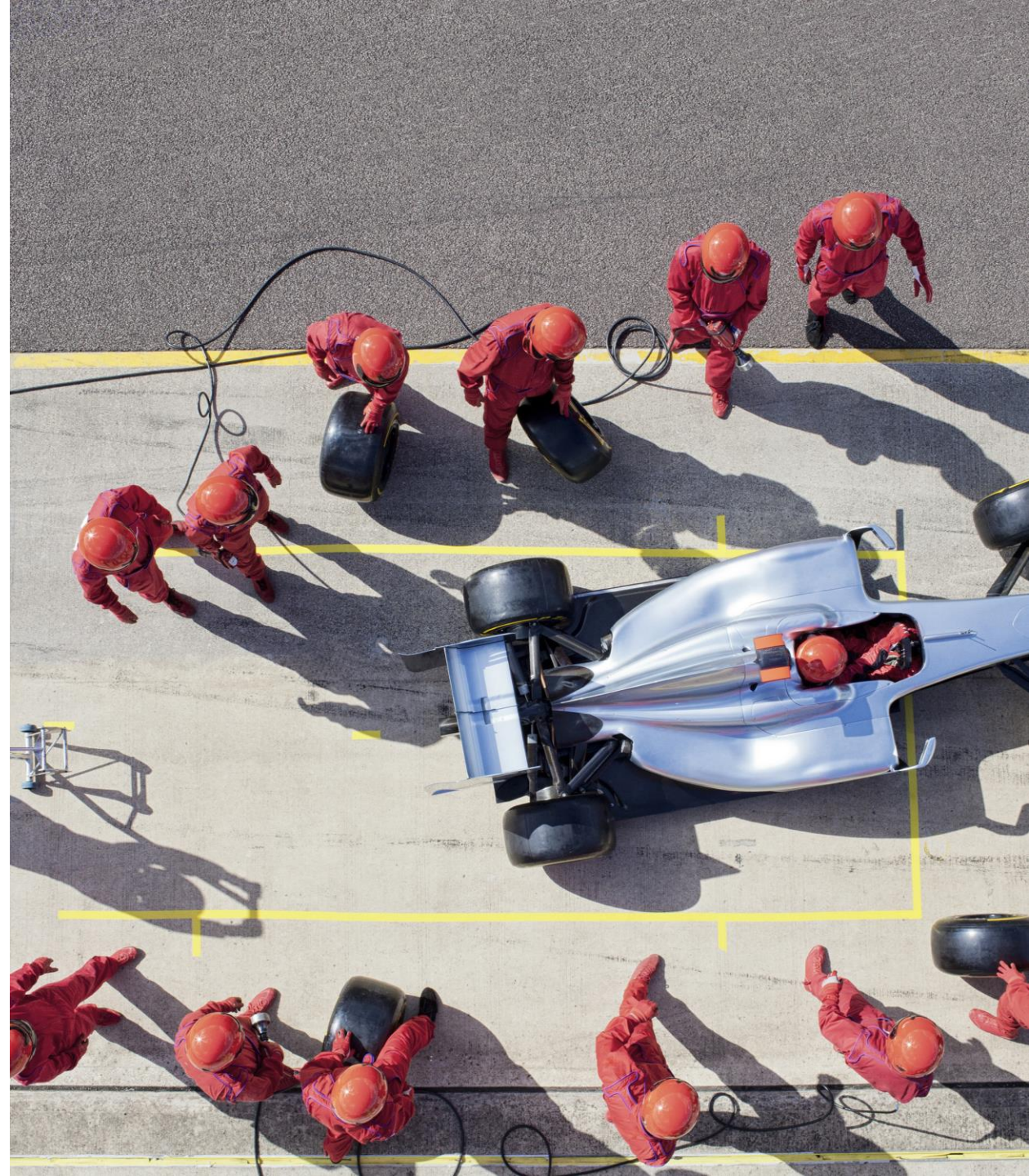
5G SA Roaming Trials – Lessons Learned

Taking guidelines and specifications to real world deployments

UE 5G SA Builds

- Software builds on UEs need to be verified to ensure they are capable of scanning and attaching to 5G SA networks – especially internationally and for Roaming scenarios

- Not all OEMs currently have international 5G SA roaming builds. Testing to date has been on Android OS only (Apple working with MNOs on SA international roaming build)

UE VoNR Support

- Not all UEs have builds and/or chipsets capable of supporting VoNR

Specifications & Parameter Alignment

- Not all core providers and MNOs interpret 3GPP specifications in the same way

- Not all 5G SA implementations will follow GSMA guidelines fully

- Misalignment can occur on mandatory/optional parameters in registration and PDU establishment

### Service Hub / Roaming Hub SEPP Mediation

- Due to incompatibility/misalignment issues, there will be a need for Intermediate SEPP to provide interoperability and interworking functionality

- FQDN-to-IP Address mediation

- N32c TCP/UDP Port# mediation

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5G SA Roaming Models

Different roaming models to co-exist

- **Model-1: Bilateral Design**
  - No intermediaries involved in signalling (except for IP transport); RVAS handled locally within PLMN domain
- **Model-2: Delegation of SEPP Deployment**
- **Model-2.1: Outsourced SEPP**
  - Outsourced SEPP (located within MNO domain) provided by external provider to a single MNO
- **Model-2.2: Hosted SEPP**
  - SEPP (located within Service Provider domain) provided by external provider to a single MNO
- **Model-2.3: Centralised/Operator Group SEPP**
  - Outsourced SEPP can be provided by operator group within Group domain on behalf of its affiliates
- **Model-3: Delegation of 5G SA Signalling Management to Service Hub**
  - Non-transparent proxy, aggregating signaling of multiple MNO members of Service Hub, enabling an MNO to outsource the roaming signaling management to Service Provider
- **Model-4: Delegation of 5G SA Roaming Management to Roaming Hub**
  - Non-transparent proxy, aggregating signaling of multiple MNO members of Roaming Hub, enabling an MNO to outsource the roaming management (signaling, billing, testing, etc.) to Service Provider
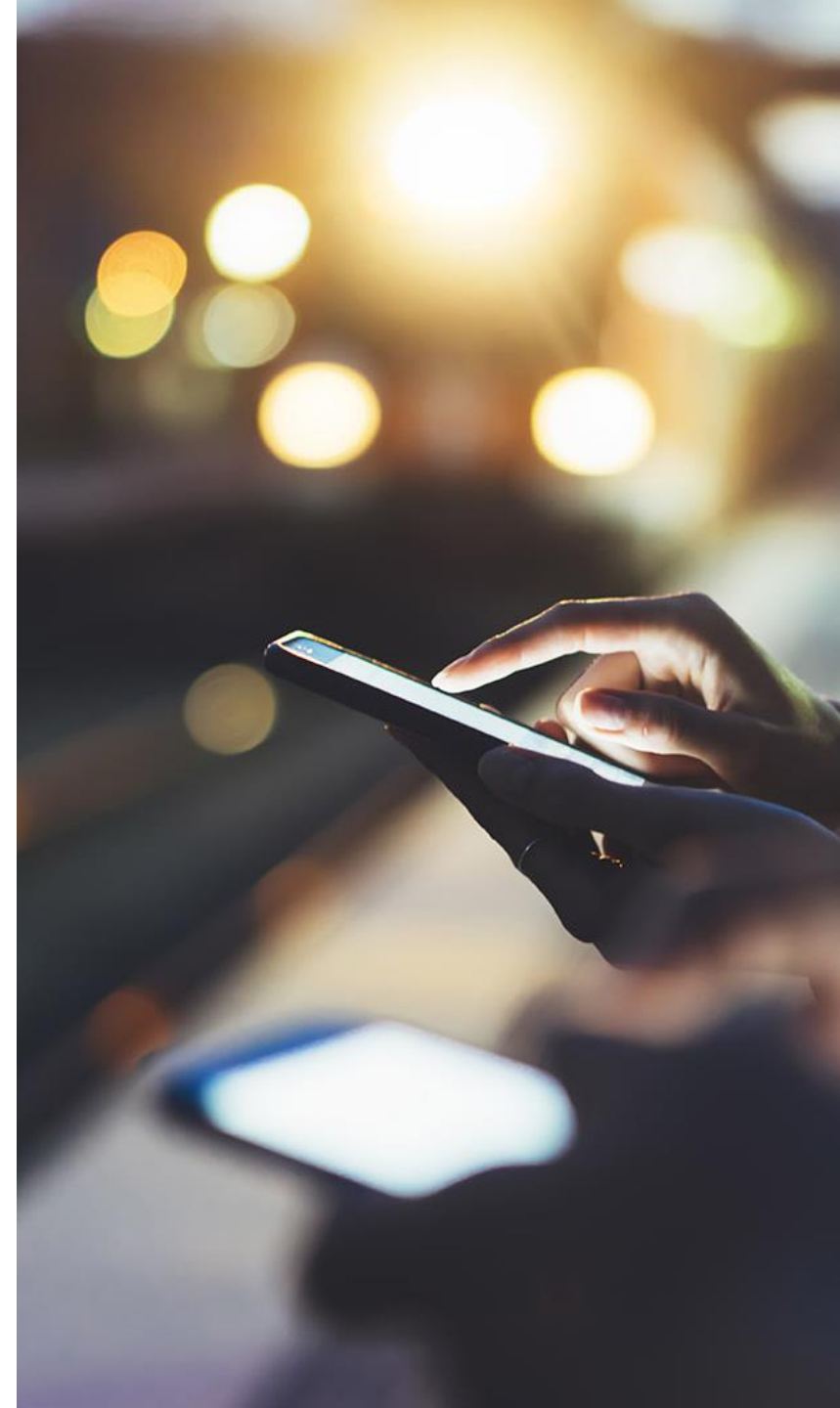
5G Roaming Challenges

- **Infrastructure and Interoperability:** There is a need for expanded testing to ensure the addition of new infrastructure and the ability to interoperate are fully

- **Voice Capabilities:** Voice capabilities present a very familiar challenge for operators for 5G roaming

- **Monetizing 5G:** Monetizing roaming services through 5G will be different as billing moves away from foundational services to the latest Billing and Charging Evolution (BCE)

- **Security Risks:** While 5G security is a big step forward, vulnerabilities and risks are still abound

- **Increase in Roaming Traffic:** The skyrocketing number of applications, mobile subscribers who travel, and both IoT and IIoT has led to exponential growth in roaming traffic

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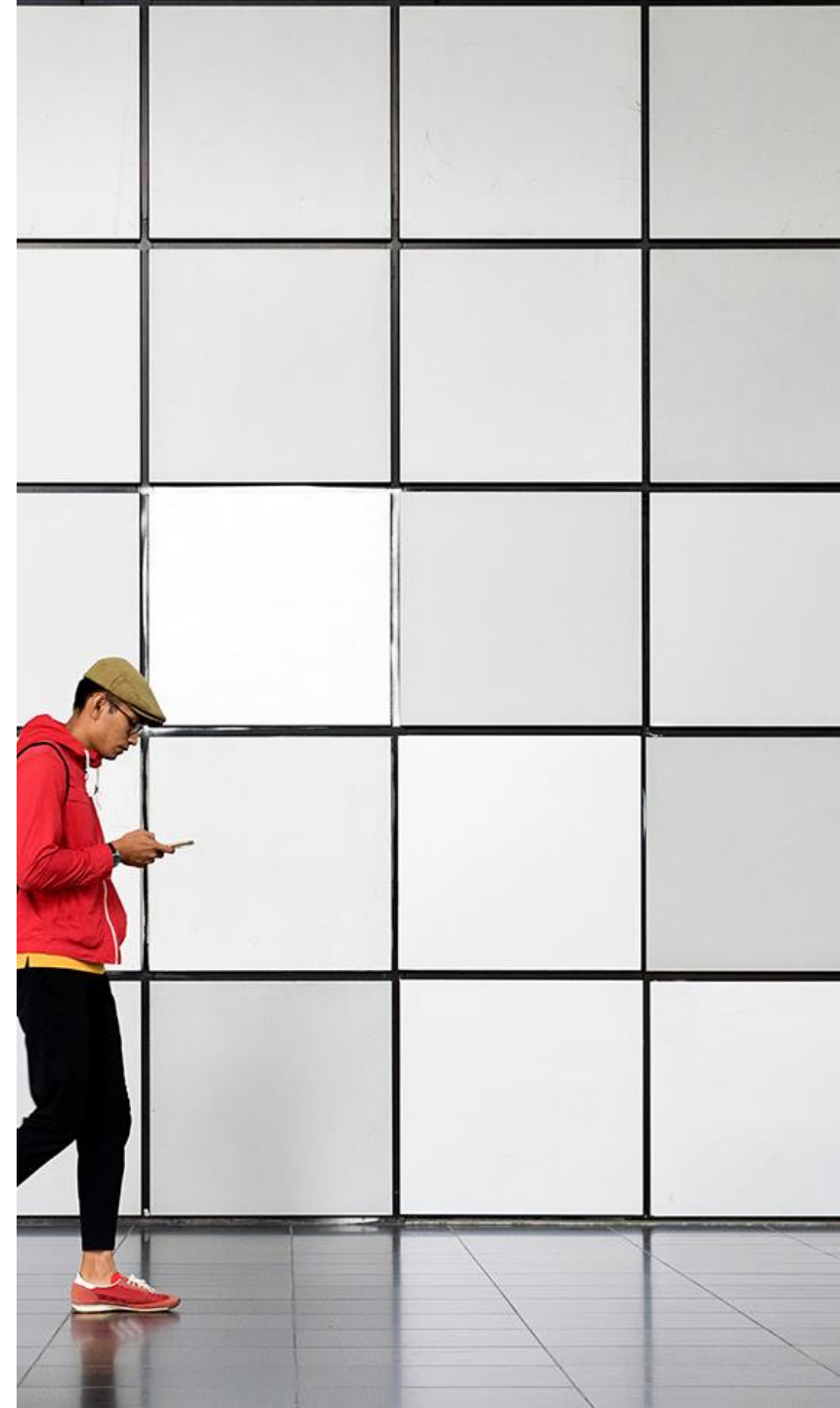
5G VAS Challenges

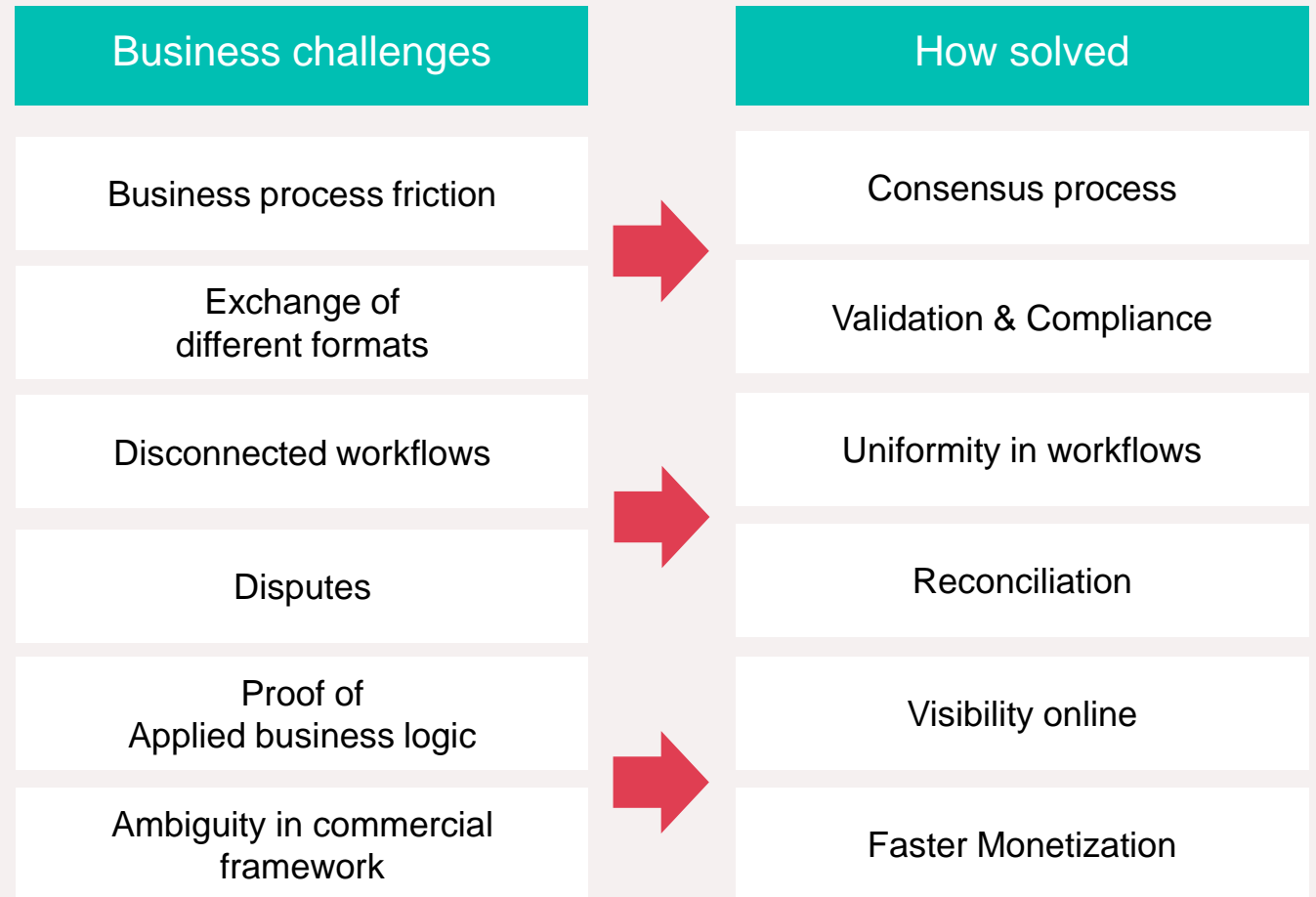## 5G security advancements make outsourcing value-added service complex

- Higher level of security makes provision of Roaming VAS more difficult
  - Zero trust model; Intermediaries are no longer treated as wall garden
- Subscriber Privacy & Authentication
  - Use of SUCI instead of SUPI to conceal IMSI
  - UE authentication confirmation to HPLMN
  - Authentication procedure binding to VPLMN identity
- Inter-PLMN Security
  - Control plane: end-to-end security between PLMN with SEPP
  - User plane: end-to-end encryption between PLMN with NDS/IP or TLS-VPN
- End-to-end Control- & User-plane Security restricts RVAS to be provided by intermediaries (IPX, Service Hubs, Roaming Hubs)
- Many 3G/4G roaming services cannot work the way they are currently deployed
  - Roaming Hub, Sponsored Roaming, Steering of Roaming, traffic visibility and roaming roaming policy solutions

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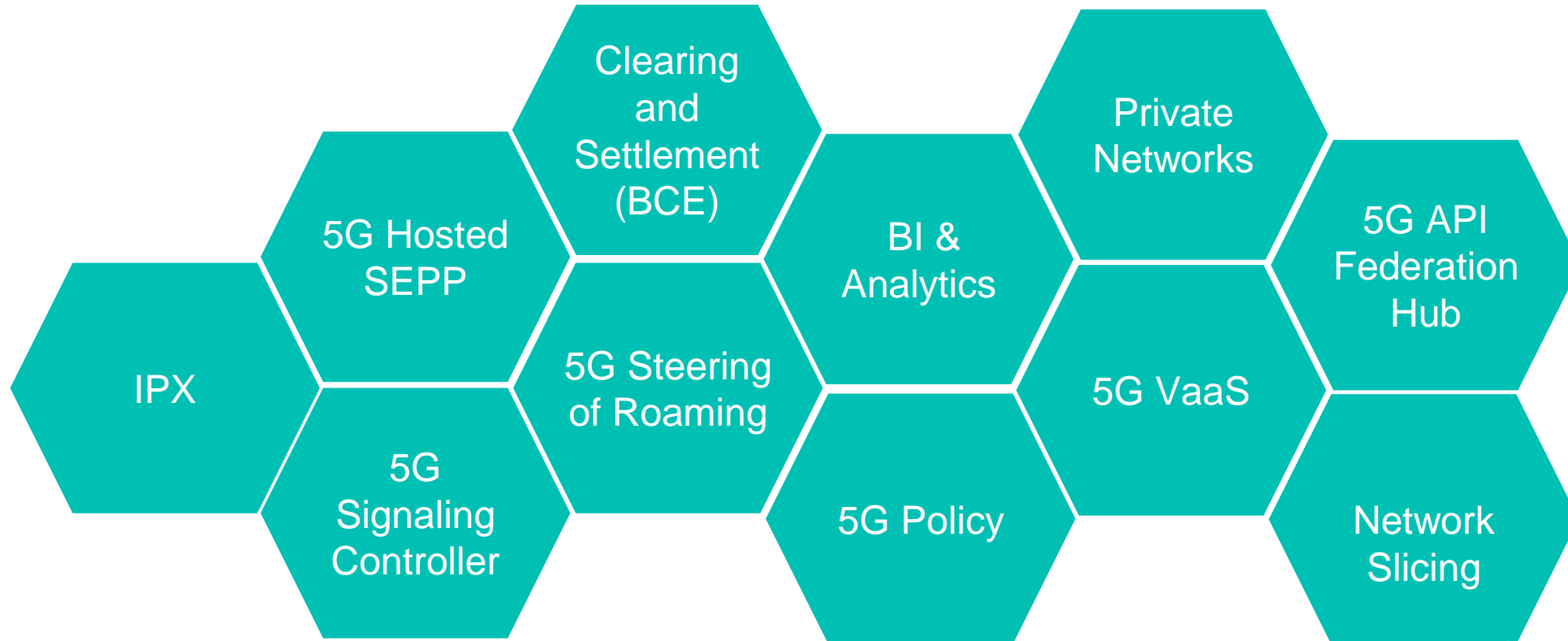# Address Business Challenges to Monetize Wholesale Roaming

Introducing Syniverse Universal Commerce for BCE

- With 5G SA everything is new…
  - Networks
  - Technologies
  - Use cases
  - Usage patterns
  - Commercial models
- In 5G SA the current TAP solution will no longer be supported, BCE must be incorporated into your 5G SA planning
- Syniverse is the only vendor working on new BCE 2.0 standards
- 90% of Operators using BCE use Syniverse Universal Commerce
  - 61 total customers
  - 19 In production
  - 14 In implementation

Business challenges	How solved
Business process friction	Consensus process
Exchange of different formats	Validation & Compliance
Disconnected workflows	Uniformity in workflows
Disputes	Reconciliation
Proof of Applied business logic	Visibility online
Ambiguity in commercial framework	Faster Monetization

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Syniverse Integrated 5G Solution Model

Integrated solutions to drive service delivery and revenue growth for MNOs

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