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WAS#13

VoLTE & 5G ROAMING ROUNDTABLE

March 16, 2021 | Virtual Session

BE THERE FIRST

ROUNDTABLE OBJECTIVE

Stimulate interaction and **information sharing** with Mobile operators on VoLTE Roaming and 5G Roaming, despite limitations of its virtual nature

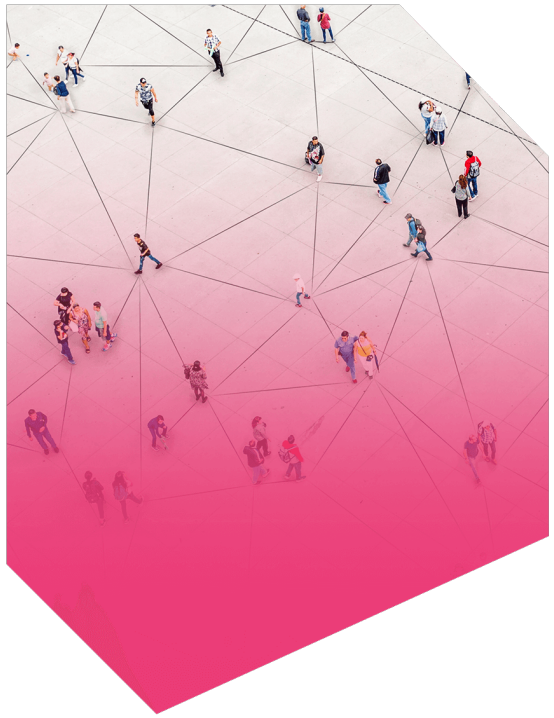
A pragmatic and **constructive** discussion, allowing early adopters to find each other and share their experiences and the ecosystem they benefit

ON THE AGENDA

14:00 – 14:05	Welcome & Introduction Session Objective & Agenda	Patrick George, EVP Product & Business Development, iBASIS
14:05 – 14:15	VoLTE & 5G Roaming Outlook	Nitin Bhas, Strategy & Insight Lead, Kaleido Intelligence
14:15 – 14:20	Operator's Perspective: Reliance JIO	Luc Lamoureux, Director International Roaming and Network Planning, Reliance Jio
14:20 – 14:30	New Security Risks	Jimmy Jones, Global Telecom Business Development Lead, Positive Technologies
14:30 – 14:40	Operator's Perspective: Verizon	Jason Olivieri, Manager Roaming Marketing, Verizon Customer Group
14:40 – 14:45	Automated Network Settings eXchange in 5G	Gerrit Jan Konijnenberg, Chair of Advisory Board, RoamsysNext
14:45 – 14:55	5G Roaming Interconnection Challenges	Mehmet Turunc, 5G Product Lead, iBASIS
14:55 – 15:00	Conclusions & Wrap-up	Patrick George

VoLTE & 5G Roaming Outlook

Nitin Bhas
Strategy & Insight Lead
Kaleido Intelligence



Kaleido Intelligence

VoLTE & 5G Roaming Outlook 2021

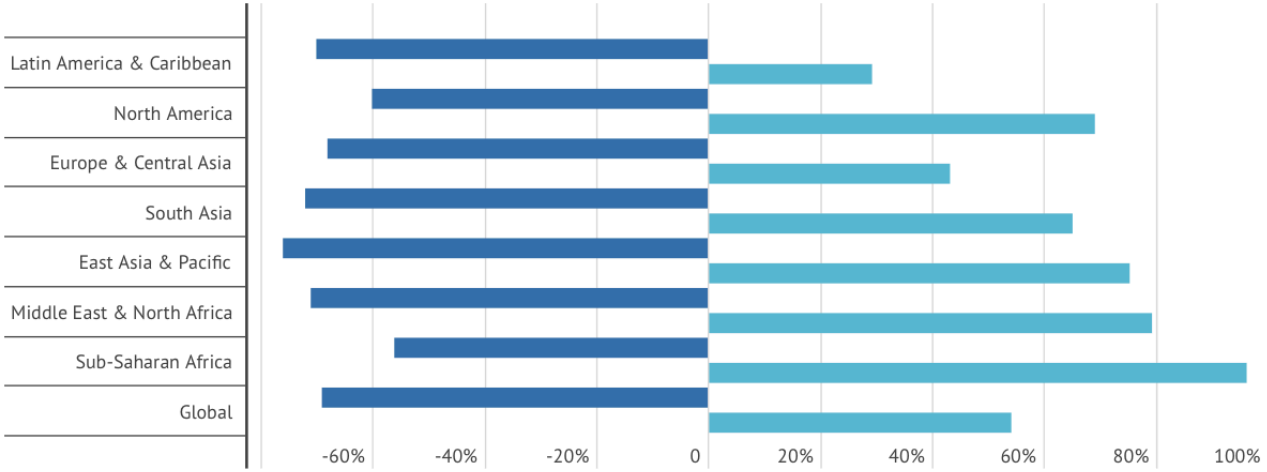
iBASIS VoLTE & 5G Roundtable WAS#13

Presentation by Kaleido Intelligence

roaming.kaleidointelligence.com

COVID-19 Impact on Mobile Roaming & Recovery Predictions

Growth in International Roaming Trips: 2020 vs 2021

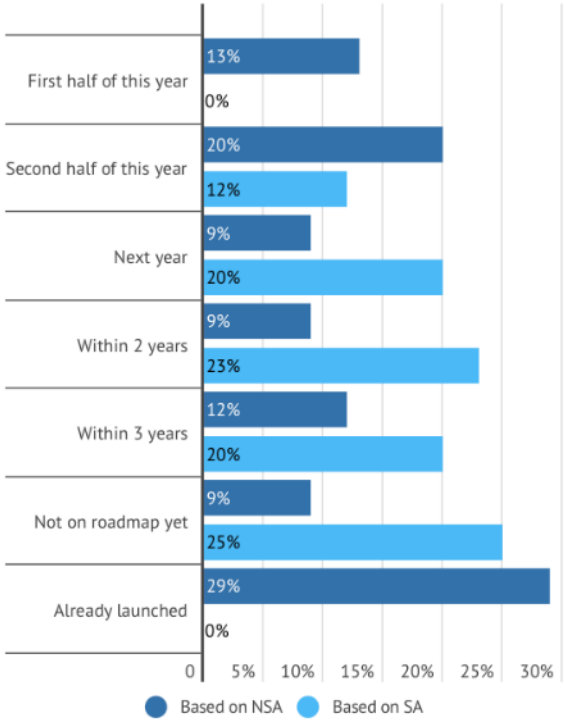


Inbound Roaming Data Traffic Recovery Projections: in Petabytes of Traffic 2022

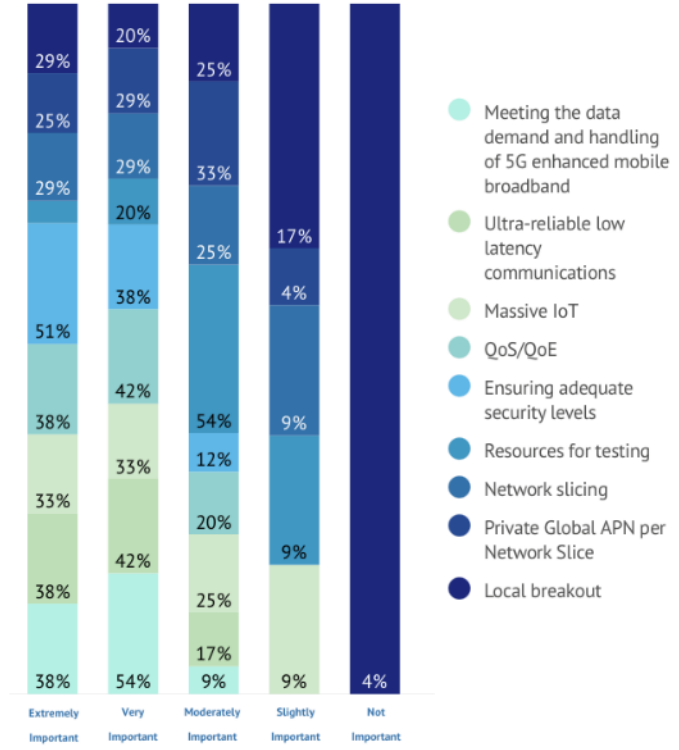
Kaleido expects international travel trips to remain lower than pre-COVID-19 levels in 2021, representing 827 million trips in total. Data roaming traffic will exceed pre-COVID-19 levels by 2022, compared to a full travel recovery by 2024.

5G Roaming Market Status & Outlook

5G Roaming Deployment Plans: When will you launch 5G roaming? (Select based on NSA/SA architecture) n=69



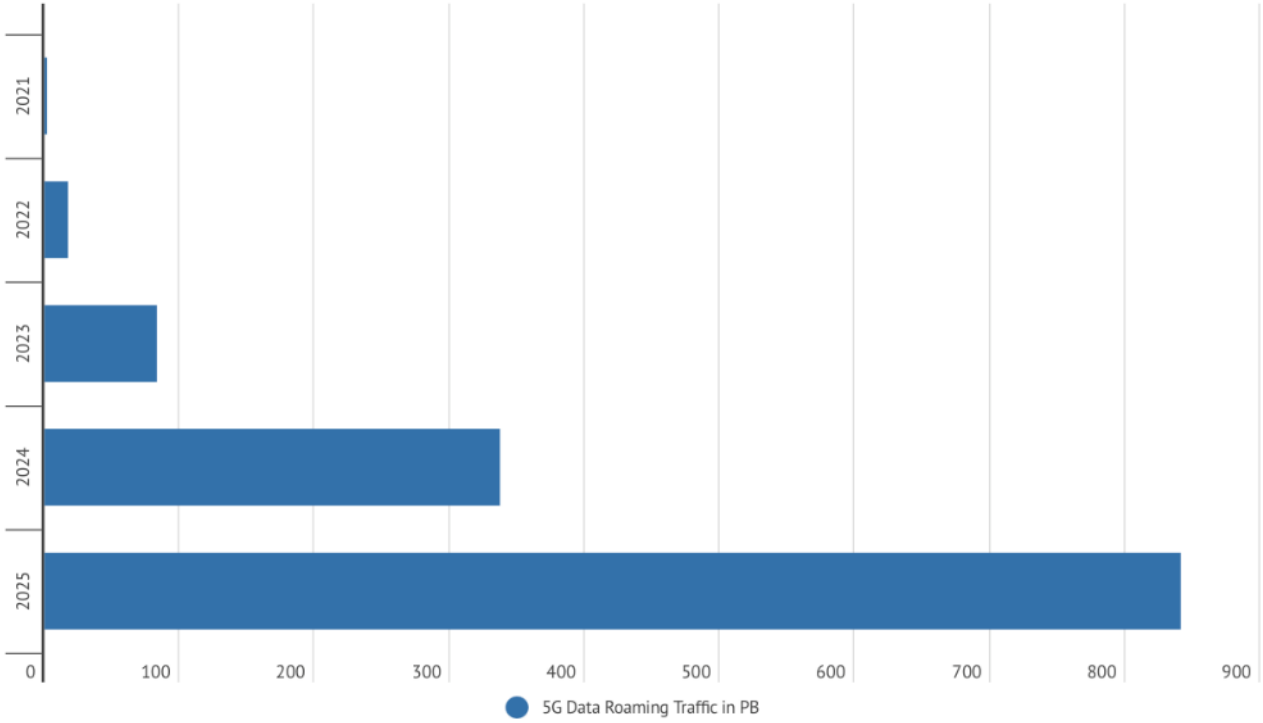
Drivers for 5G IPX Deployment: What are the most important factors you consider to be needed for 5G IPX deployment? n=69



5G consumer adoption is predicted to be significantly faster than for 4G. Global 5G connections will reach 1.4 billion in 2022, before reaching 3.9 billion in 2026.

5G Consumer & IoT Roaming Outlook 2025

Growth in Outbound 5G Data Roaming Traffic in Petabytes, Consumer & Cellular IoT Device Traffic



With 5G roaming traffic expected to account for 38% of total data roaming traffic generated by consumer mobile and IoT connections by 2025, the operator's IPX vendor must be capable of managing any capacity requirements

Kaleido Intelligence

FREE WEBINAR: 5G ROAMING OPPORTUNITIES by iBASIS & Kaleido Intelligence

Ajay Joseph

Chief Technology Officer, iBASIS

Nitin Bhas

Chief of Strategy & Insights
Kaleido Intelligence

Steffen Sorrell

Chief of Research
Kaleido Intelligence

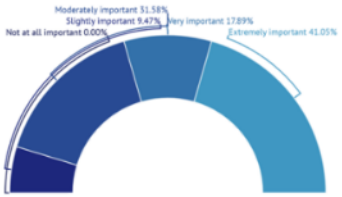
REGISTER TODAY

Date & time:
Tuesday, April 13th at
17:00 CET | 11:00 EST

Webinar agenda:

- **Impact of COVID-19 on Mobile Roaming & Recovery Prediction**
- **5G Roaming Market Readiness & Deployment Plans**
- **5G Roaming Traffic & Revenue Projections**
- **5G MNO Requirements & Opportunities**
- **How to Succeed: Best Practice & Recommendations**
- **5G Roaming Roadmap: 2021-2027 & Beyond**
- **Q&A**

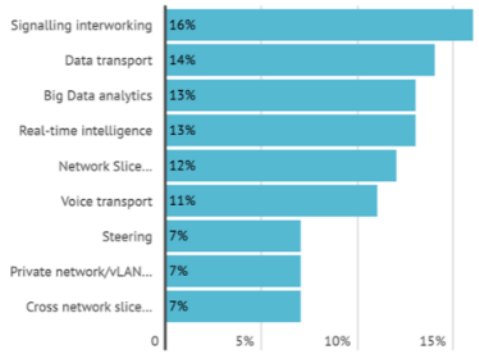
Nearly 57% of survey respondents observed that the ability of the IPX vendor to support advanced network-slicing function is very or extremely important.



While launching 5G roaming based on NSA architecture, the most immediate requirements were found to be:

1. SECURITY
2. VOLTE ROAMING
3. HIGH-BANDWIDTH SUPPORT WITH EXTENDED QOS

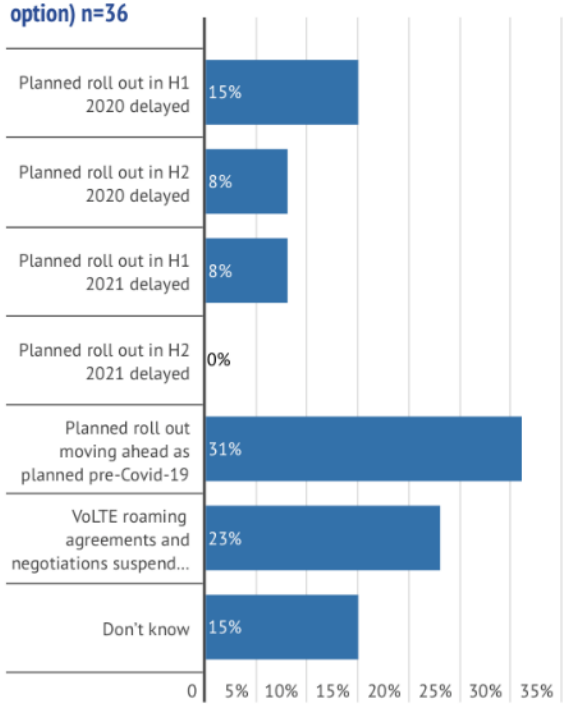
According to the survey, signalling interworking, data transport and big data analytics were found to be the top 3 most important 5G roaming service innovation that operators expect from their IPX vendor.



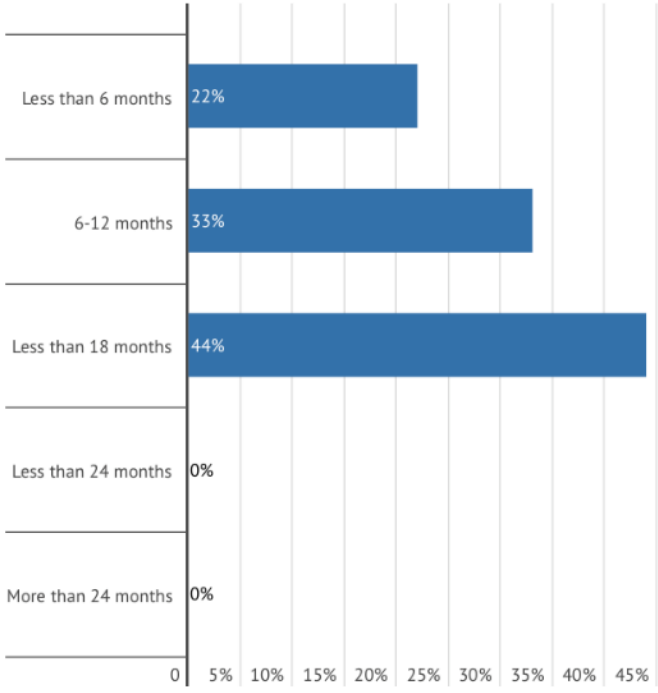
roaming.kaleidointelligence.com

VoLTE Roaming Market Status & Outlook

What is the impact of COVID-19 on your VoLTE roaming launch plans, if you have not already launched as of H1 2020? (Select one option) n=36



By how long has COVID-19 delayed the launch of VoLTE roaming? (Select one option) n=25

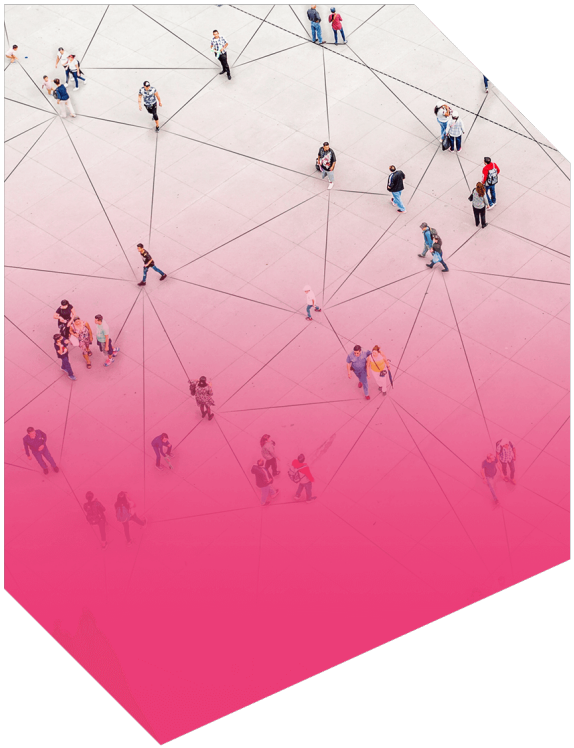


Operators must continue with VoLTE roaming rollouts with minimum delays in order to support both short and long term objectives including 5G roaming roll out and the sunsetting of 2G and 3G networks.

Operator's Perspective: Reliance Jio

Luc Lamoureux
Director International Roaming and Network Planning

Reliance Jio



JIO VoLTE experience

- VoLTE roaming is picking up!
- Architecture is Home Routed (S8HR) ONLY
- Voice and Video on LTE is charged on Volume in TAP 3.12
  - 1Mb of Data gives around 3 minutes of talk time for VoLTE
  - Will create multiple records for each call
    - QCI 1 = Voice
    - QCI 5 = SIP signaling (May be a long duration and have multiples calls span)
    - QCI 2 or 8 = Video
  - MAP values for QCI into Call Type Level (CTL) 2
- IPSEC must be off at P-CSCF for Lawful Intercept for certain Countries like India
  - Having encryption may prevent launch of VoLTE roaming
- Preferred testing method is with Mobileum/SIGOS

New Security Risks

Jimmy Jones
Global Telecom Business Development

Positive Technologies

A New Generation of Security

- 236 million across the world by the end of 2020 (up 66% from Q2) 4 times quicker than 4G to hit that number.
- 5G roaming subs will reach 147 million by 2025, a growth rate of 3,300% over the next four years.
- Network complexity increased by orders of magnitude

Unprecedented Growth

- Massively accelerated move to virtualization
- Adoption of new protocols and architecture
- Diversification and innovation in new applications, services and infrastructure (IoT)

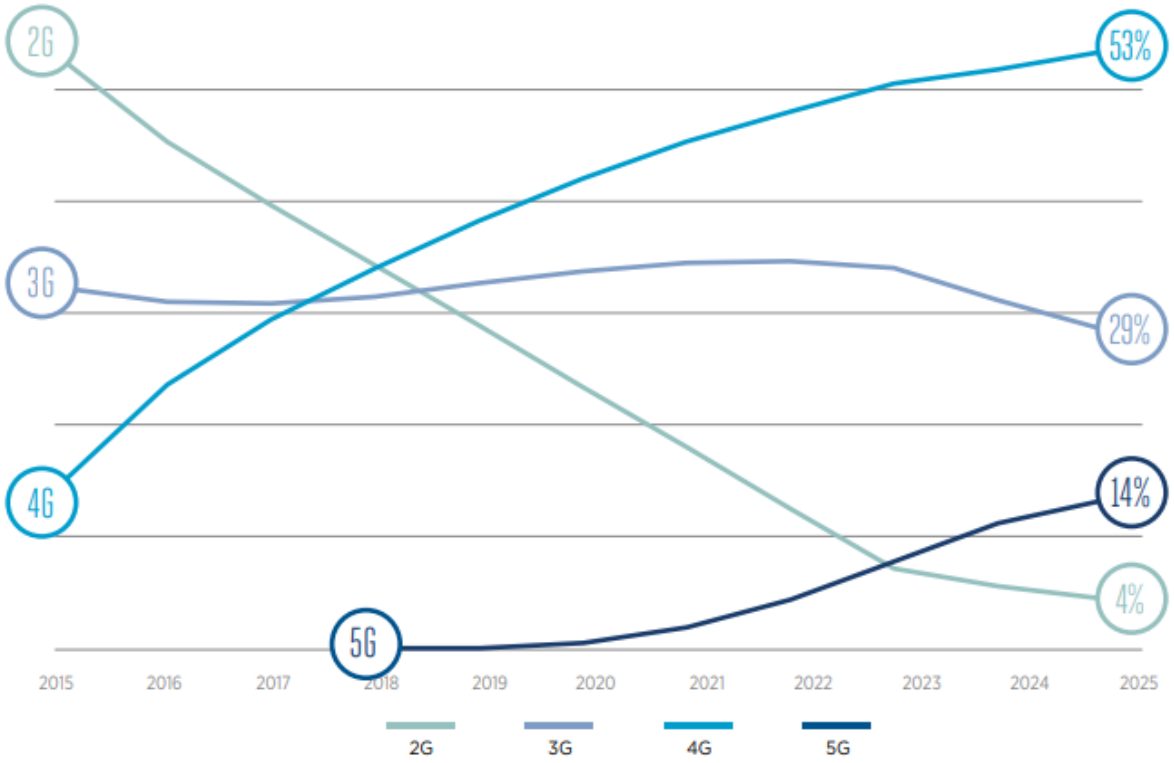
Consolidation & Innovation of Technologies

- Evolution to new architecture complex
- Rollout requires huge resources but day to day maintenance and security must be continued
- Process & administration complexity increased by orders of magnitude

Disparate Coexisting Networks

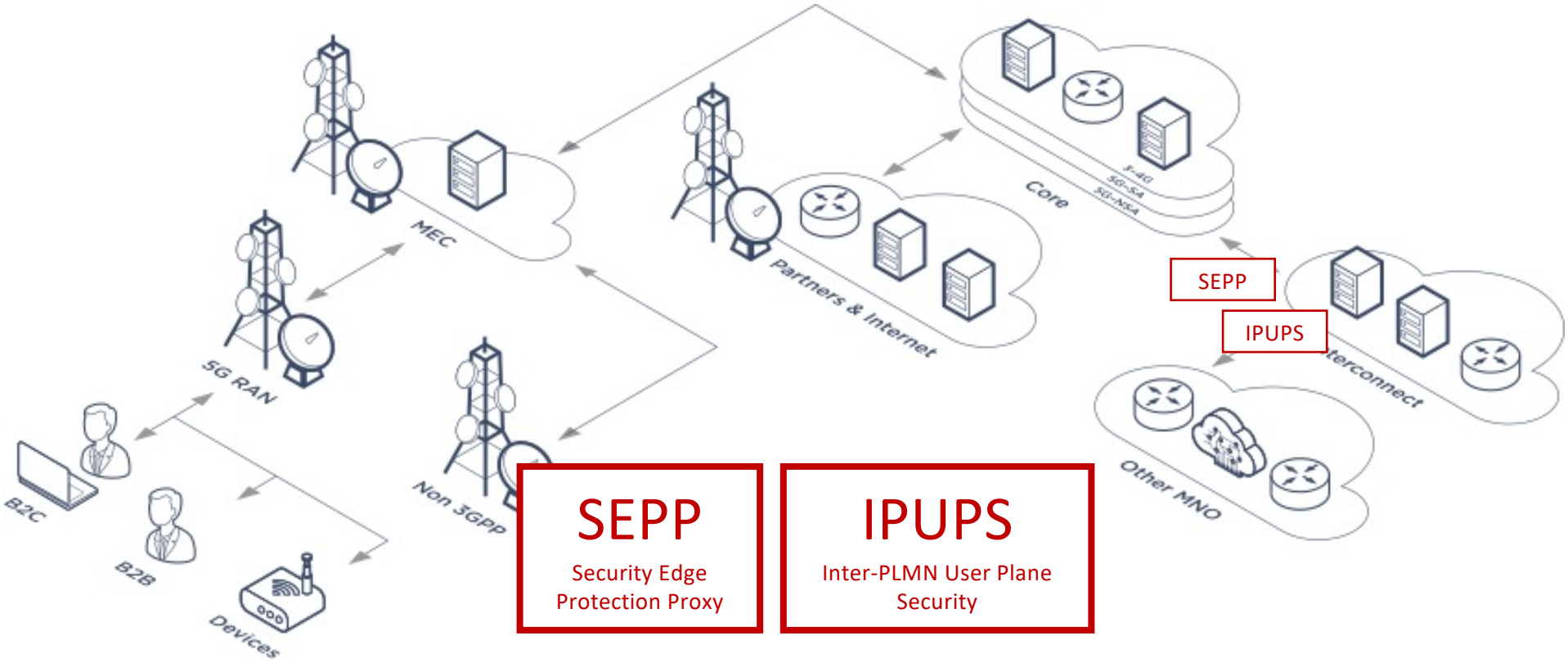
Data provided by Omdia & Juniper Research

Market Share - 2G/3G/4G/5G



Source: https://www.gsma.com/wp-content/uploads/2019/04/The-5G-Guide_GSMA_2019_04_29_compressed.pdf

5G Roaming New Boarder Functions



SEPP

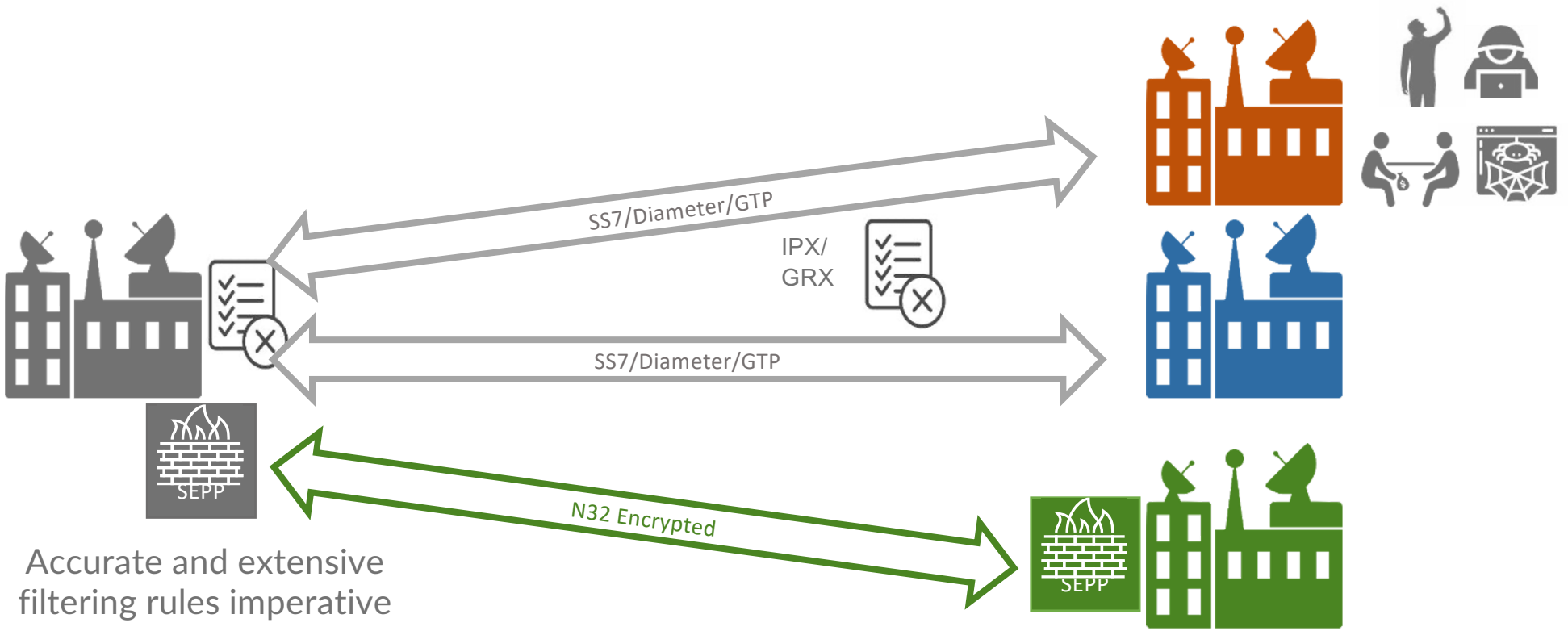
Security Edge Protection Proxy

IPUPS

Inter-PLMN User Plane Security

Positive Technologies

Roaming Thru the Generations



Accurate and extensive filtering rules imperative to ensure security

5G Roaming - Filtering

Low-Layer

- Detection of simple spoofing attempts, as well as ensure the validity of th
  & JSON message structure.
- Based on lower network and transport layer information, s
  format.

CAT1

- Category 1 filtering focuses on
  internal interfaces
- Whitelists based
  method

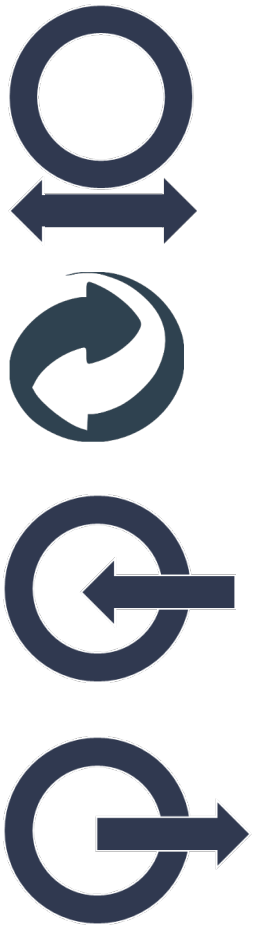
CAT2

- ample, using a
  subscriber IDs
- works. Improved 5G functionality
  MCC and MNC that can be compared to

CAT3

- 5G ng of category 3 messages is based on the subscriber's location.
- New authenticates using data derived using visited network details which home network can compare. CAT3 from other sources can be dropped
- NB As earlier generations 5G Auth process requires 5G location velocity check

COMPLEXITY & HIGH ADMINISTRATION
=
CONFIG ERRORS & SECURITY ISSUES



Early 5G Research

Researchers showed potential issues with 5G Core security allowing:

- Deletion of network functions to create potnetially huge
- Gathering of data such as current physical location, and network access info
- Hackers to provide subscribers service with fake network functions

Interface used by IPUPS

- DoS
- Man In the Middle

The Future of Telecom Security

- Growth
- Consolidation & Innovation
- Coexistence
- Agility
- Cooperation
- Diligence

Act Now, Be Prepared……

Operator's Perspective: Verizon

Jason Olivieri
Manager Roaming Marketing
Verizon Customer Group

VoLTE & 5G Roaming

Operator perspective

Jason Olivieri

verizon

VoLTE

Circa 300 operators globally investing in VoLTE

- VoLTE-HD
- VoLTE roaming

Challenges and lessons learned

- Emergency calling
- Compliance of IR.88
- Lawful intercept
- Device enablement

Conclusion

- OEM's enabling VoLTE roaming faster or by default
- 2nd half of 2021 - large uplift in VoLTE roaming relationships globally

Resources : GSMA www.gsma.com VoLTE ROAMING TASKFORCE www.volteroaming.com

5GNSA

Device
EN_DC Combo
Bands
Certification
18 month lead time

Configuration
Enabled device
AVP modifications
CSFB 3G

Post testing
Customer launch

5GSA

5G Adoption

Network Monetization

Next-gen B2B Applications

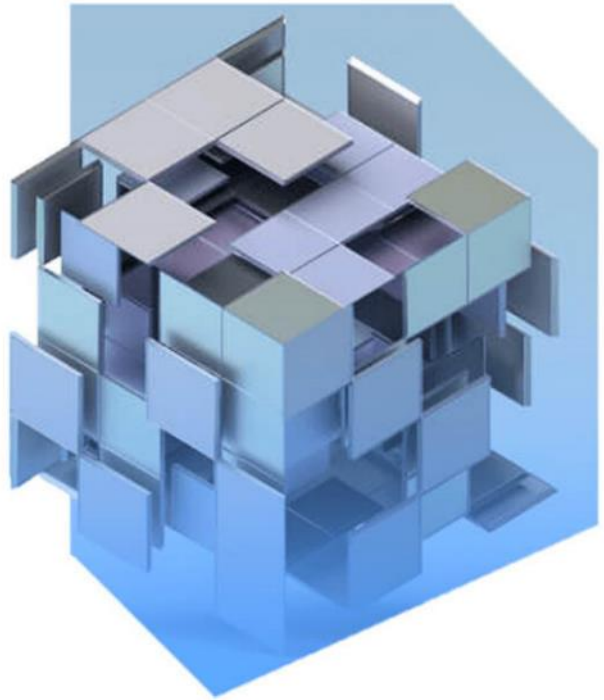
Customer Differentiation

New Markets

- To fully **activate the 8 currencies** of 5G for new forms of commercialization
- To enable new **immersive consumer experiences**
- To enable **large enterprises** to **configure and control** their **network experiences**
- To address **competing demands** on network from **divergent 5G use cases**

Automated Network Settings eXchange in 5G

Gerrit Jan Konijnenberrg
Chair of Advisory Board
RoamsysNext



Overview of Innovation Steps

4G

5G

2007

Founding

ROAMSYS is founded in Germany and we release our first product **easyRAEX**

2008 – 2009

Early success

Flying start of RMS – first customer acquisitions in the US, EU, Asia and Australia

2010

Official GSMA IR.21 application supplier

First RAEX IR.21 application on the GSMA InfoCentre. More than 6600 active users

2011

Product improvements

More flexibility for Rollouts, performance improvements

2013

Exclusive GSMA RAEX provider

The company's headquarters were moved to Luxembourg. ROAMSYS builds the IOT/Op Data application for the GSMA.

2014

Award winning RMS

RMS gets expanded and is elected "Operational support tool of the year" by ROCCO

2015

Most complete RMS in the market

ROAMSYS is one of two vendors who are rated as Tier 1 in an independent industry survey.

"There is no RMS tool which is more complete than Roamsys RMS."

2016

Xceed RMS

Launch of the Xceed suite, the most complete roaming management system in the market

2017

IREG Toolbox Pro

ROAMSYS launches the innovative IREG Toolbox Pro, allowing operators to fully automate their core network configuration.

2019

RoamsysNext

Diversifying the existing business and exploring new opportunities

2020

Network Configuration Optimiser

Allowing operators to automate their network settings via API's .

2021

Fraud Intelligene Servive

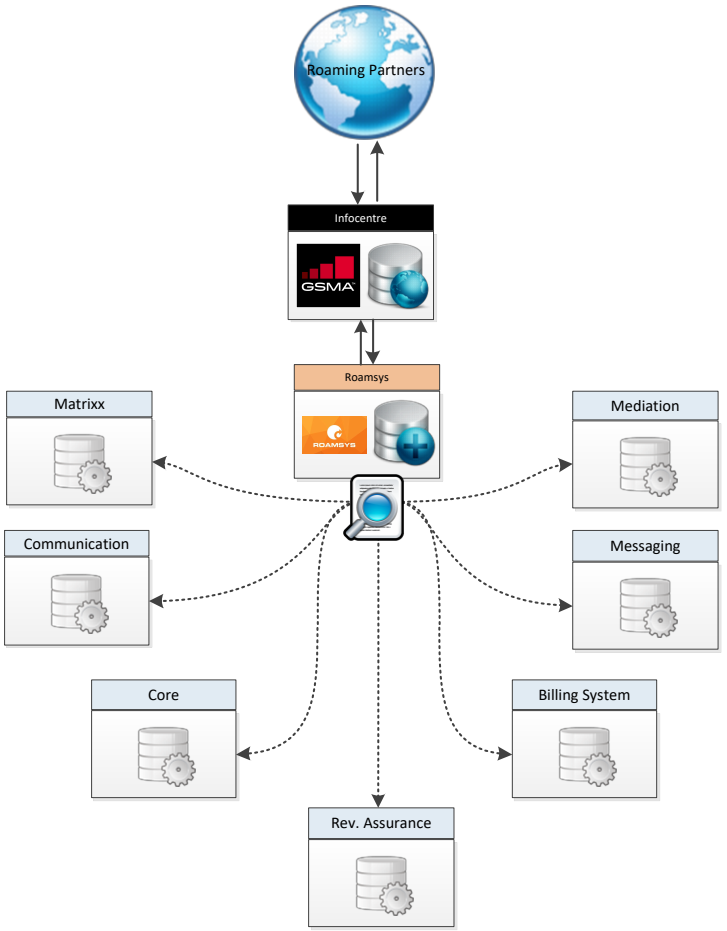
For the GSMA (powered by RoamsysNext) we launched FIS to exchange HRN via API and database checks.

ROAMSYSNEXT

Example of fully automated end-2-end configuration

The Problem of MNO group

- With more than 550 roaming partners and
- a flow of 30-40 updated IR.21 documents per week,
- it is heavily cumbersome to handle the constant updates on a manual basis which allocates resources from multiple departments who
- manually needs to examine, extract data and update only tied to the specific department..
- always playing catch up and have a delay – and fragmented, different updates from a single IR21 are update at different times / staggered approach
- thus, never have a fully single updated partner….



The Solution

With a MNO Group we joined forces and developed a tool:

- which automatically downloads IR.21 documents from the GSMA Infocenter database,
- passes the content, extracts and categorizes relevant data based on receiver (FW/HLR)
- to then distribute the content in a file format readable for the recipient.

Fully automated !!

Always updated !!

Conclusions

- Roaming is getting more complex (closures/launches)
- Need for standardization (BCE) and quality input (IR21)
- Growing need for automated network settings exchanges

ROAMSYSNEXT

Gerrit Jan Konijnenberg
Chair Advisory Board

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5G Roaming Interconnection Challenges

Mehmet Turunc
5G Product Lead
iBASIS

iBASIS IPX INNOVATION MODEL

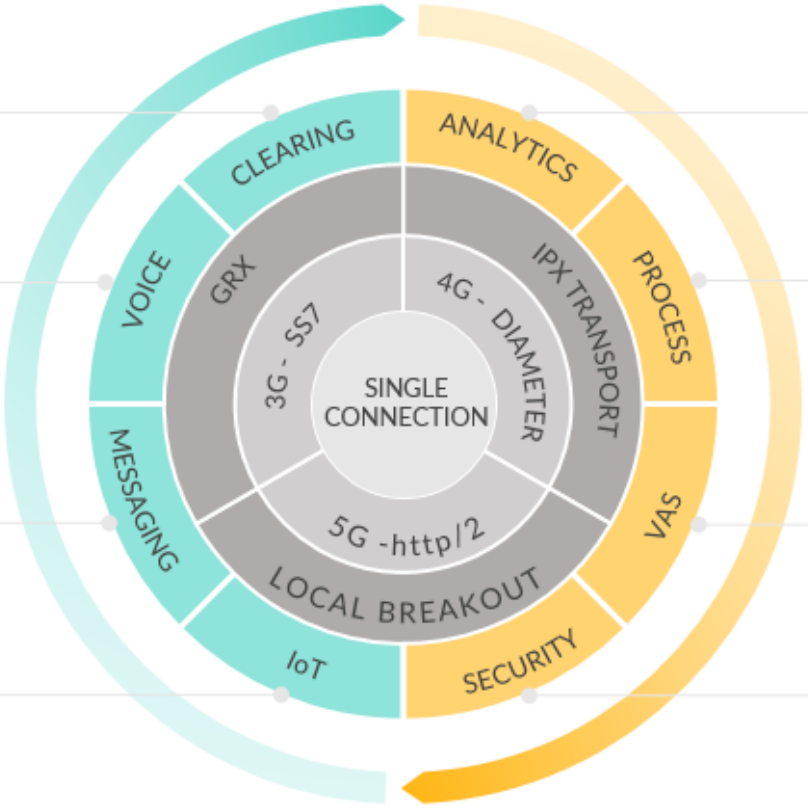
OPTIMIZE REVENUES

Financial Clearing
Data Clearing
Settlements

VoLTE Roaming & Interconnect
Voice Termination
Cloud Communications

SMS A2P Termination
SMS P2P
SMS Firewall

IoT Data Access
Local Breakout
Policy Control



OPTIMIZE COST

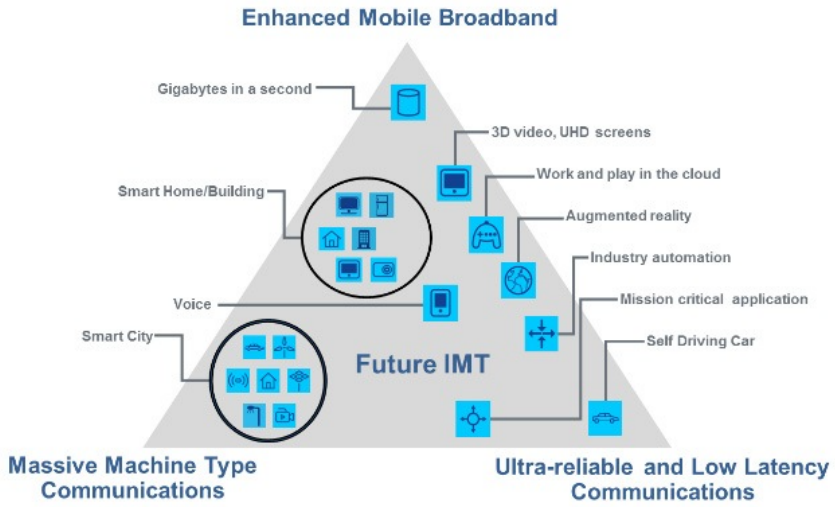
Quality Monitoring
Troubleshooting
User Insight

Sponsored Roaming
Automated Trading
Implementation
Management

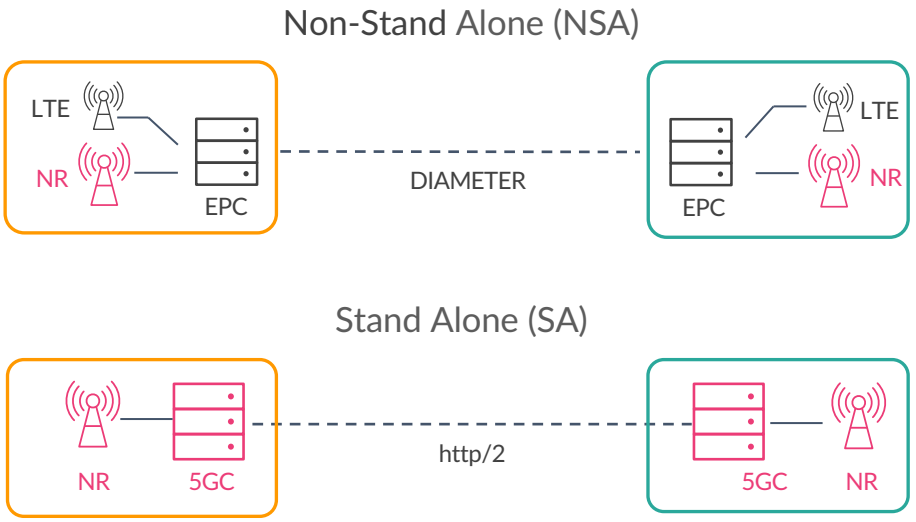
Steering of Roaming
Welcome SMS
Virtual Home
Environment

Signaling Firewall
Vulnerability Screening
DDOS prevention

WHAT 5G BRINGS



Source: ITU IMT-2020



New players:

- Private 5G Networks
- Cloud Service Providers
- NB-IoT service providers/chipset manufacturers
- IoT VAS providers

Completely changed **core network**:

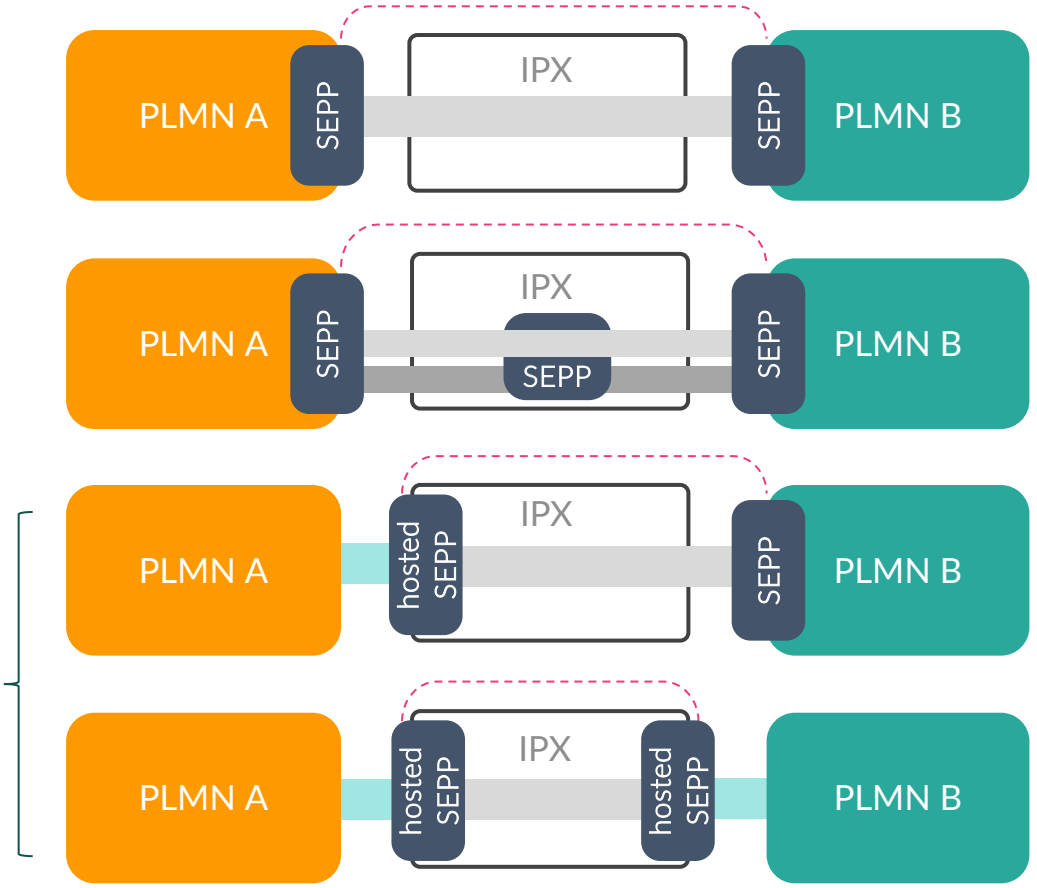
- Service based architecture
- Cloud native network functions
- New protocol: http/2

ROAMING INTERCONNECTION MODELS

End-to-End TLS

PRINS

Hosted / Outsourced SEPP



- Signaling information is end to end encrypted and not visible !

- Designed for intermediators (a 3GPP standard)
- MNOs can decide which parts of the signaling messages can be seen/modified

- Requires a trust relationship between MNO(s) and IPX provider
- Signaling messages are visible
- Need to follow legislation closely

WHAT ARE THE CHALLENGES & WHO ARE IMPACTED

Business Challenges

When the signaling information is not visible:

- MNOs need to manage signaling routing by themselves (data routing is not affected)
- Analytics, VAS and Security services cannot be provided to MNOs

Technical Challenges

When the operation is handled by the MNO:

- One feasible solution to cover all possible roaming scenarios
- Security operation in roaming (SEPP deployment, certificates, key exchanges etc.)
- SLA and troubleshooting responsibility

Who are impacted

MNOs / MVNOs

VAS Providers

Security Services Providers

IPX Providers

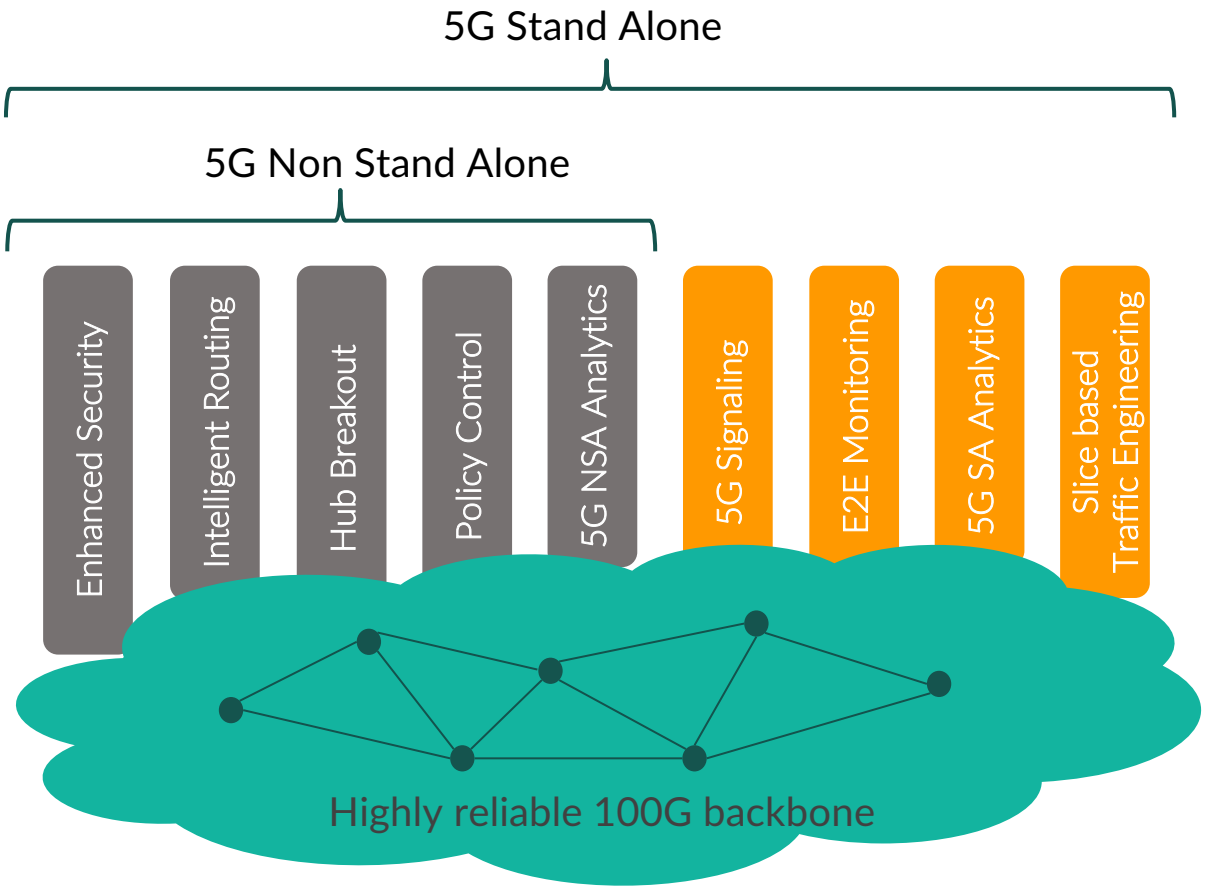
Roaming Hubs

5G Core Network Vendors

We need to strike a balance between full security and ease of operation for the MNOs **without losing business features** which the roaming ecosystem has now

- **Full security** means MNOs have to invest and manage the signaling interconnections by themselves with all SLA responsibilities
- **Ease of operation** refers outsourcing SEPP and security operations
- **Business features** mention the ability to access the signaling data which MNOs get cloud-based services from their IPX/VAS/RH/Security providers

iBASIS - 5G READY - NETWORK EVOLUTION



LET'S CONTINUE THE DISCUSSION ABOUT THE 5G ROAMING JOURNEY

iBASIS INNOVATION EXCHANGE

Insights, webinars, data & demos for the exchange of new ideas

https://ibasis.com/innovation/

5G ROAMING OPPORTUNITY

Webinar hosted and moderated by Kaleido Intelligence

Tuesday, April 13, 2021
17h00 CEST / 11 AM EDT

https://roaming.kaleidointelligence.com/pf/free-webinar-5g-roaming-opportunities/

5G SIGNALING SANDBOX

5G Standalone (SA) Signaling testing for MNOs, Private 5G providers, and IPX peers.

For a trial, email contact@ibasis.net

Conclusions & Wrap-up

Takeaways

Suggestions & Actions

Continue the discussion on LinkedIn:

https://www.linkedin.com/groups/8675420/

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THANK YOU

iBASIS.COM

BE THERE FIRST