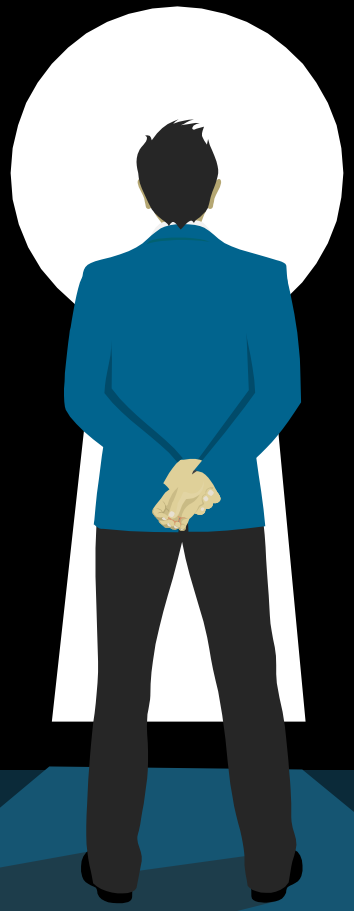
GSMA KEY MANAGEMENT
A single, automated and evolving process



ITU Workshop:
Improving the security of signalling protocols

29th of November 2021

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GSMA FASG DESS Chair

GSMA Associate Member

NetNumber

INTRODUCTION

- The exchange of key material between GSMA members was never required
- Security by design for 5G roaming introduced that need at the moment work was underway to define a Diameter End-to-End Security (DESS) for LTE roaming
- The DESS Key Management Group was appointed to work on this topic
- Already defined Stage 1 manual procedures for 5G and LTE roaming in FS.34 v1.0

- By now, there are 7 different use cases defined that can benefit from this solution
- Goal of the key management stage 2 work:

"Create a uniform, automated procedure for GSMA members to exchange key material for all use cases within the GSMA"

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5G IS AN EVOLUTION, CLOSE TO A REVOLUTION

- 5G is an evolution of LTE (4G)
- New functionality added
- Ecosystem is expanded
- Security-by-design is added

Source: https://www.3gpp.org/ftp/Information/presentations/presentations_2018/2018_10_17_tokyo/presentations/2018_1017_3GPP%20Summit_02_Key%20Note_SCRASE.pdf

SIGNALLING SECURITY IN 5G

3G

Time

Retrofit security with filter elements

Message type filter, plausibility checks

Pre-defined filter elements

Filter, plausibility checks

No confidentiality, no authenticity

All messages sent in clear text

Secure protocols

Authenticity, integrity, confidentiality

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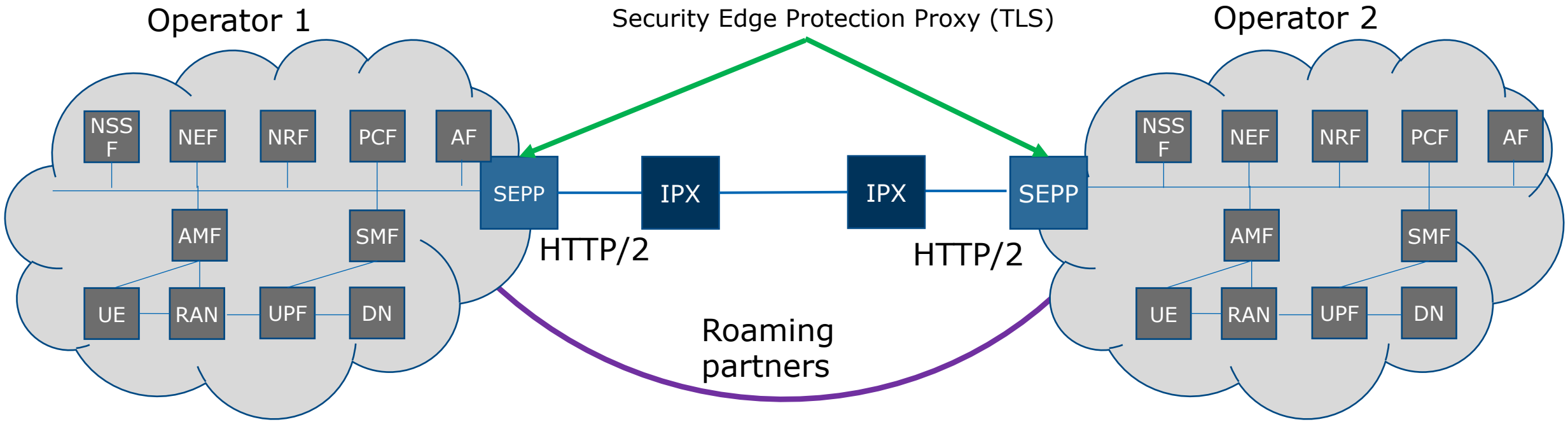
THE 5G SECURE INTERCONNECT

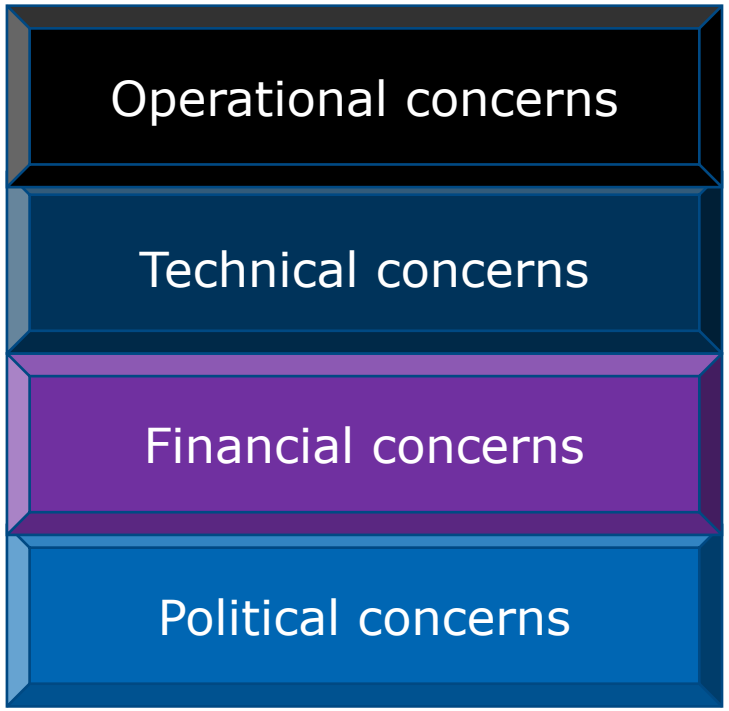


Among other models debated in the GSMA the model above is seen as the most generic model:

- Operators set-up a SEPP-SEPP TLS connection
- All roaming traffic is tunneled over that connection(s)
- Routing and network topology discovery will be end-to-end
- **Managing key material to facilitate 5G roaming is utmost important**

WHAT MAKES KEY MANAGEMENT COMPLEX?

- Hard to find a balance between:



"My roaming staff can never operate this!"

"The solution is way too difficult!"

"The solution is way too expensive!"

"Can I trust the one issuing keys or certificates?"

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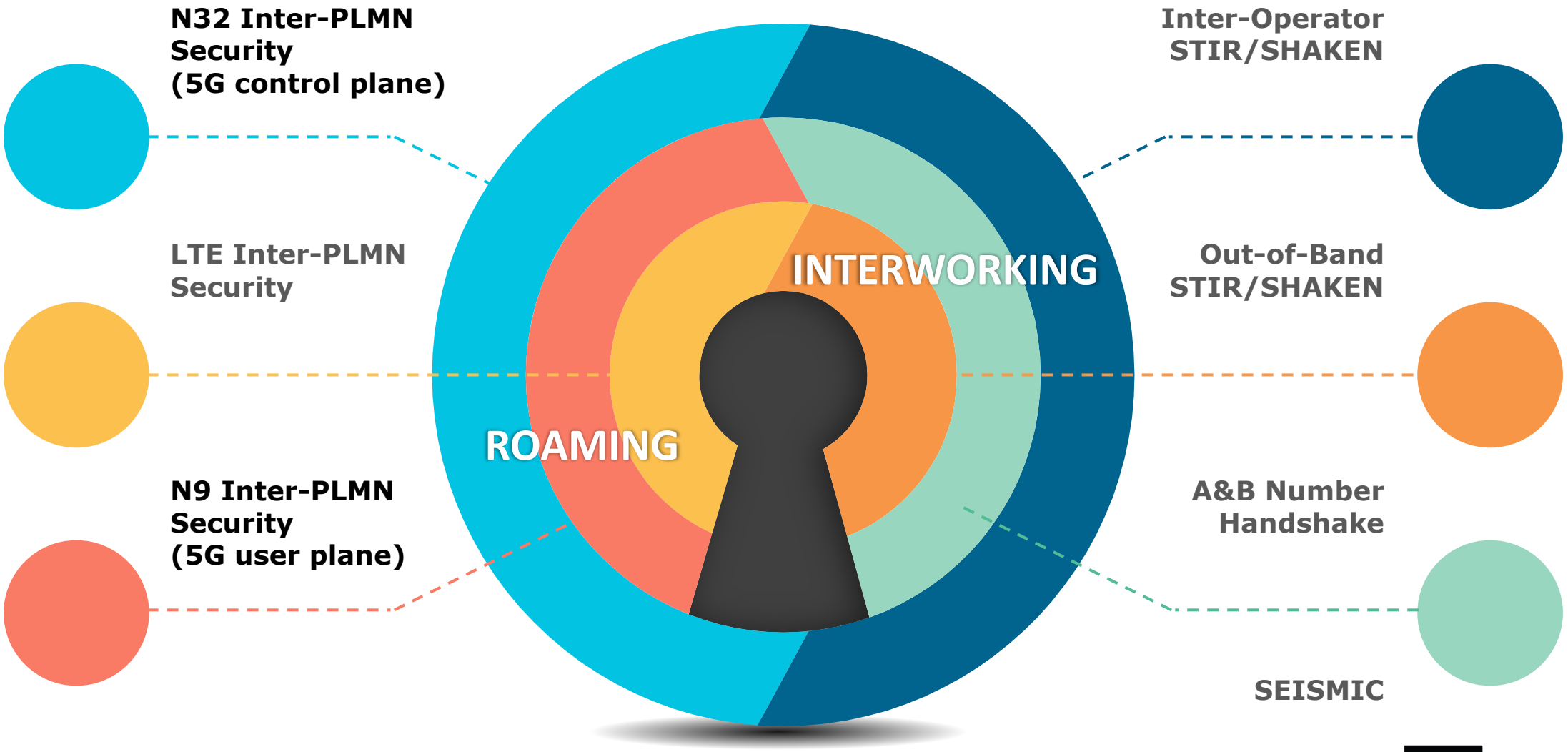
USE CASES



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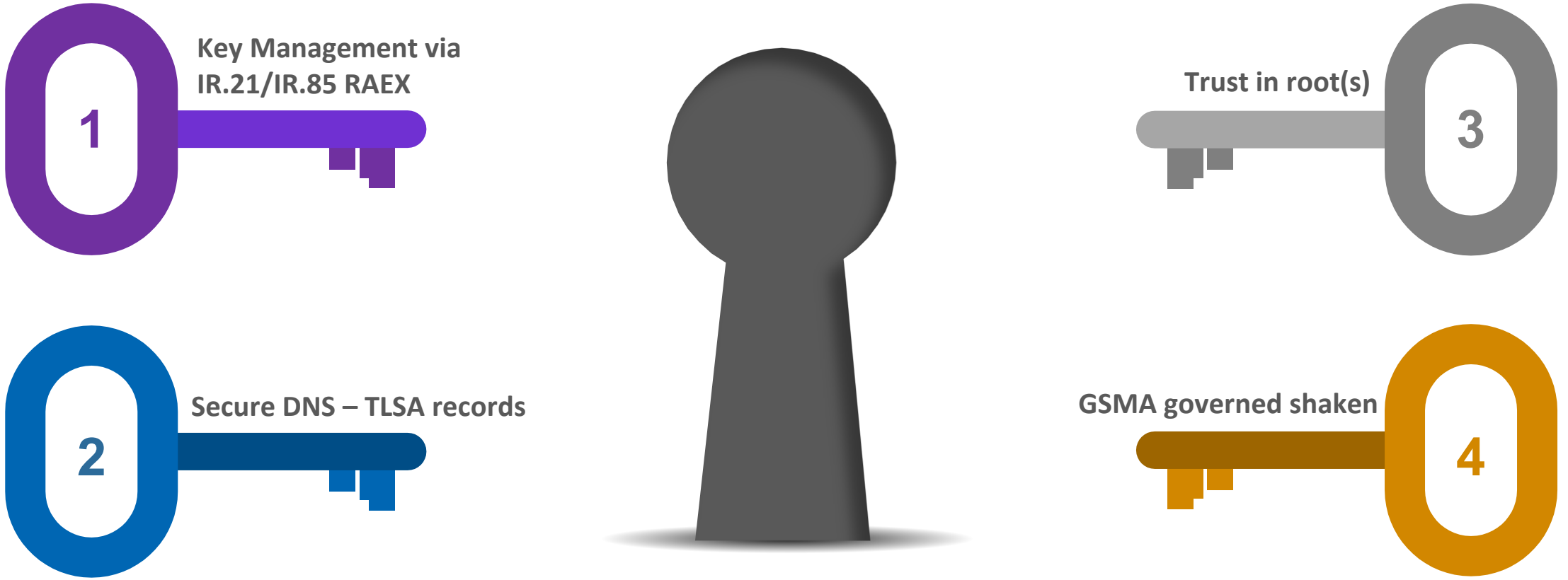
HOW TO COME TO A SOLUTION?



4 solution directions concluded for further evaluation

7 Use cases - **9** Solution directions - Weighted on **12** arguments

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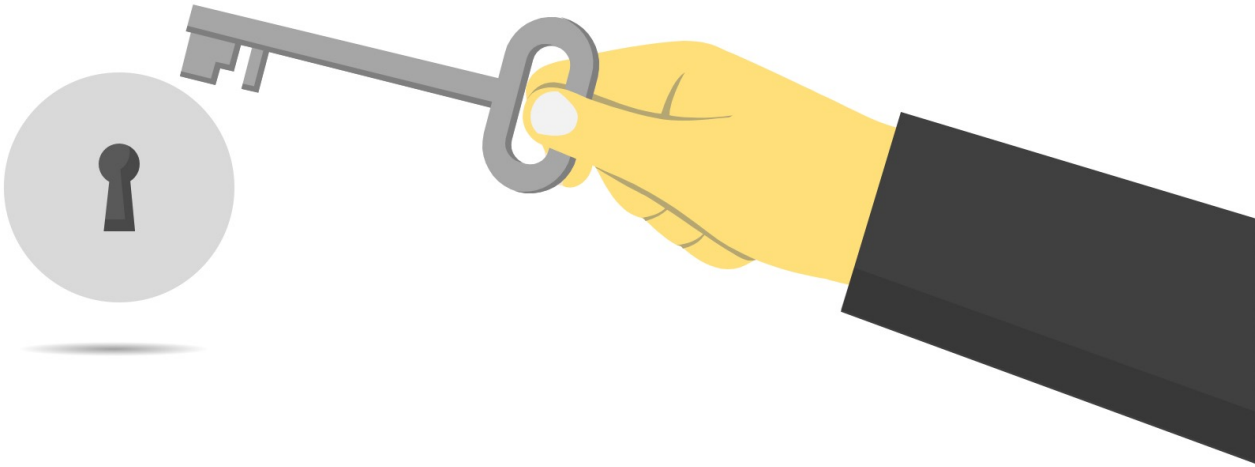
PROPOSAL: A STEP-BY-STEP APPROACH

- Neither of the solution directions are a perfect fit
- Bilateral trust provides the most trust (for roaming and interworking)
- Not likely that all GSMA members will agree to trust a single root, neither it is required
- Proposed to have a step-by-step evolving key management solution with the IR.21 RAEX as cornerstone for the certificate repository while reusing components from other solution directions



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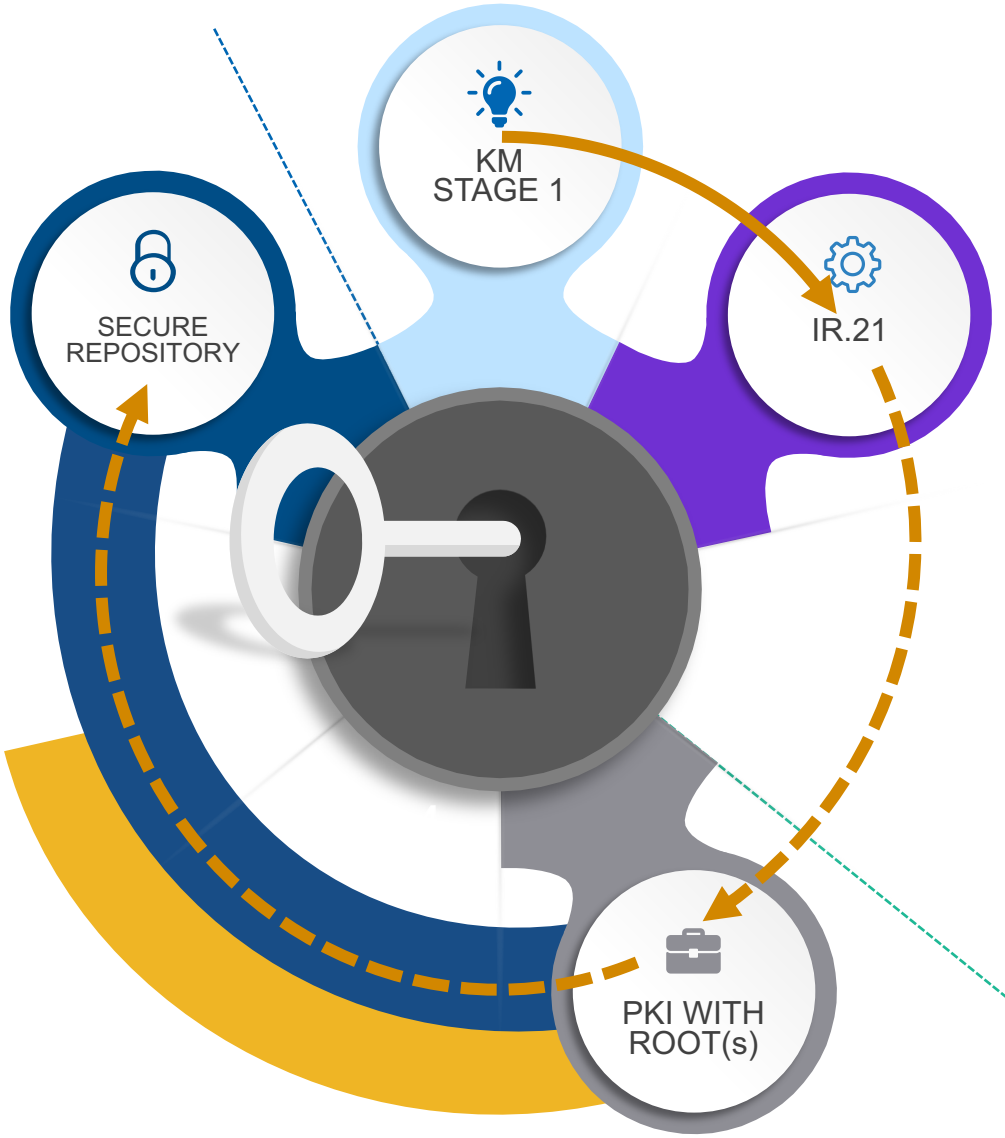
Stage 2 – Step-by-step approach

A dynamic certificate repository will maximize automation



IR.21 is **THE** tool for Mobile operators' Network administration

Self-signed certificates may be used

Certificates signed by a certain root can provide additional trust outside the GSMA secure domain e.g., governed STIR/SHAKEN

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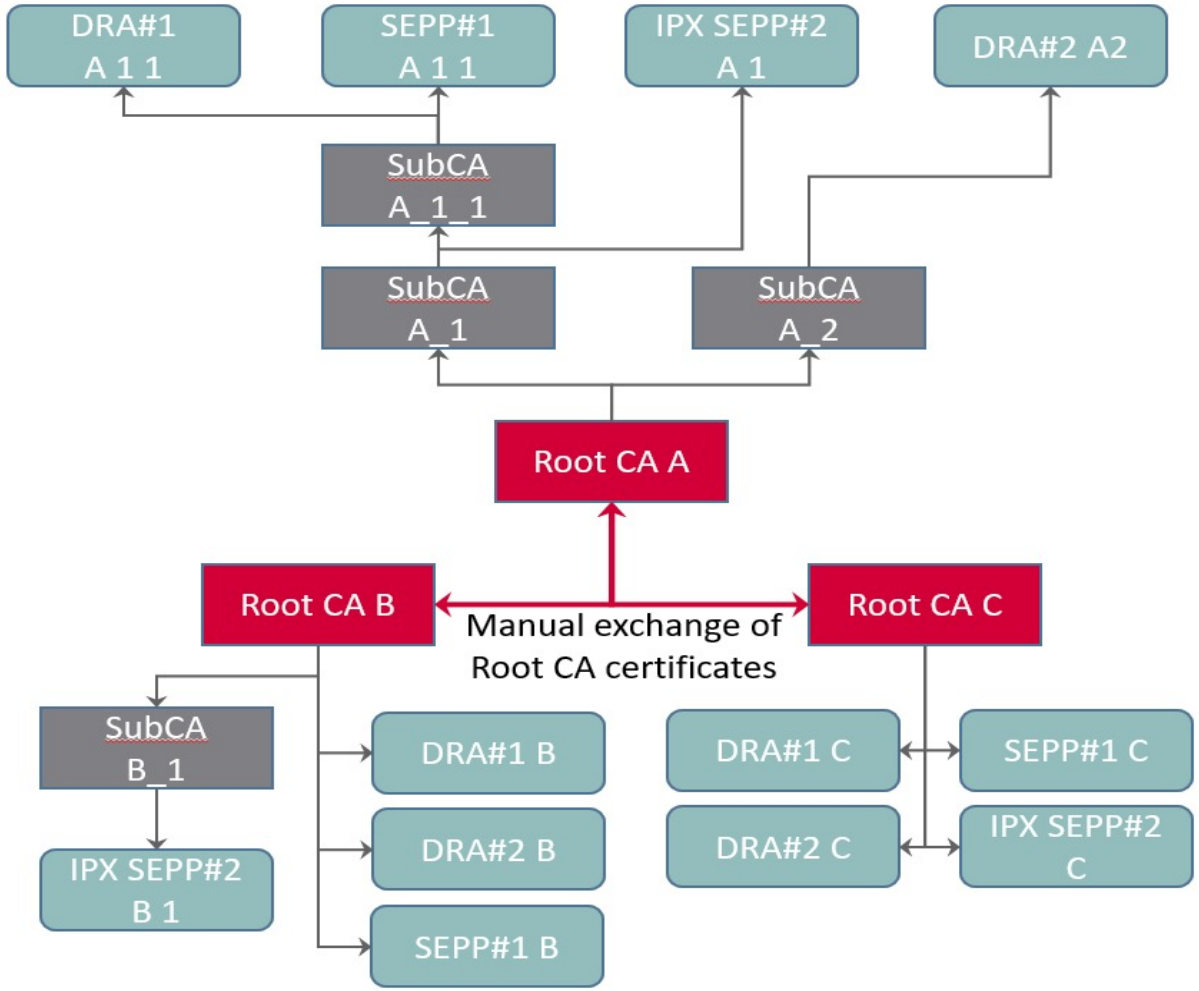
STEP 0 – KEY MANAGEMENT STAGE 1

Key Management Stage 1

FS.34 v1.0 March 2020

- Manual procedure between operators
- No governance
- Cumbersome



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STEP 1 – ENABLE KEY MANAGEMENT VIA RAEX IR.21/IR.85

RAEX Tools
IR.21 / IR.85 / IOT / Op Data

- Based on bilateral trust
- Operators to store own certificate(s) in RAEX
- Firm security and automation requirements to be set to RAEX
- Recommendation to cover usage of RAEX as mandatory for 5G roaming and to cover that contractually

Information for DIAMETER certificates exchange	
IP Addresses of IPSec GW:	
IP Address of the first IPsec GW	[List/Range/Subnetmask of IP addresses]
IP address of the second IPsec GW[101]:	[List/Range/Subnetmask of IP addresses]
Certificates available from the RAEX IR.21 Database *[102 103]*	
Certificate of first IPsec GW:	[Yes/No]
Certificate of second IPsec GW:	[Yes/No]
Operator roaming sub-CA certificate[104]:	[Yes/No]

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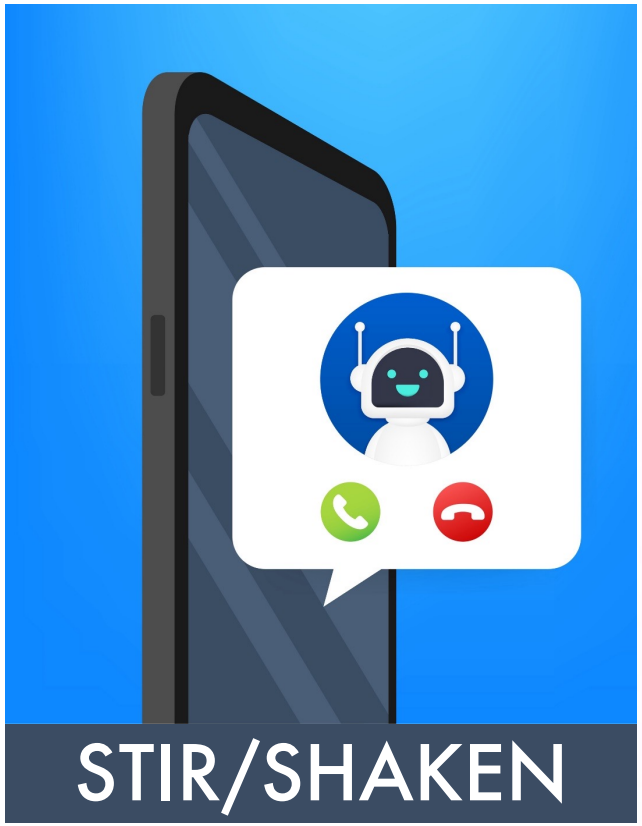
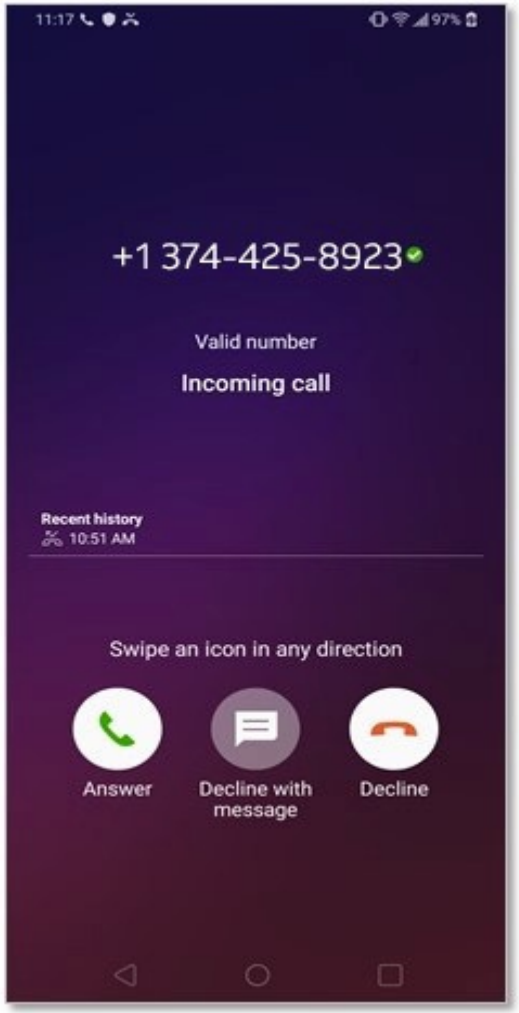
STEP 2 – INTERWORKING WITH OTHER ECOSYSTEMS

- GSMA to establish trust with the other domain
- GSMA to designate a certificate authority that has trust in other domain and facilitate vetting and onboarding of GSMA members (getting their certificates signed)
- Operators to join on a voluntary basis





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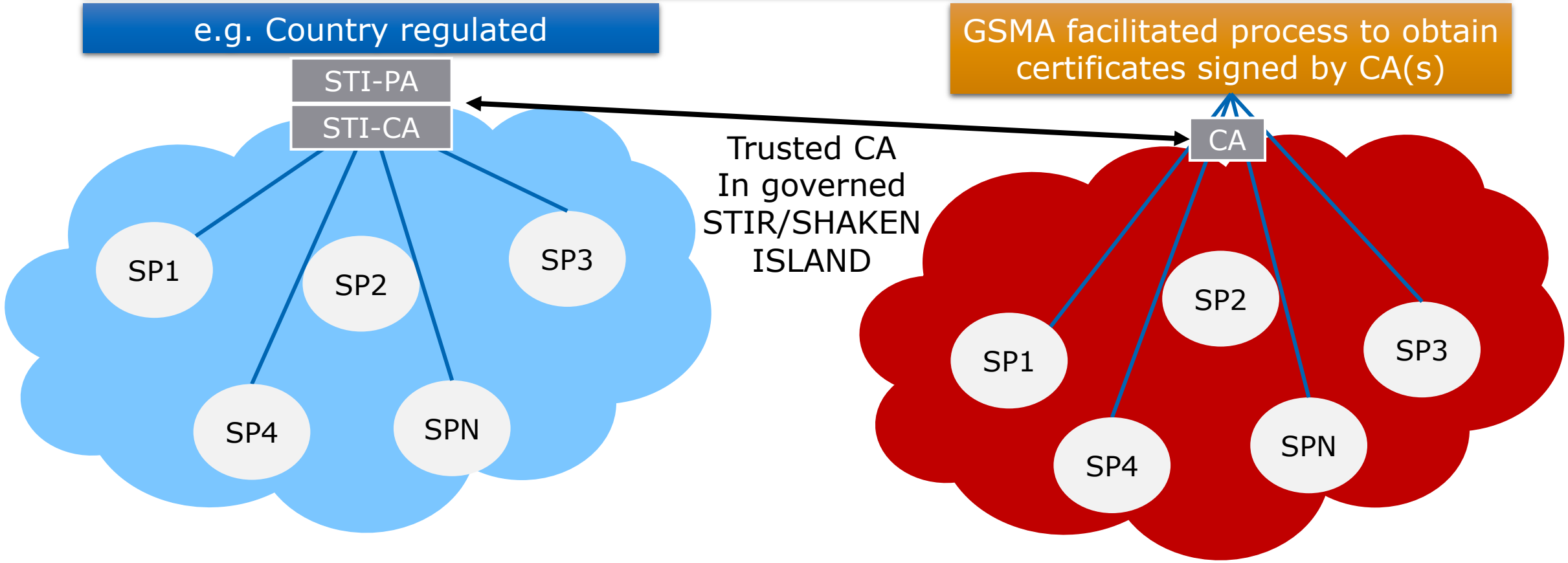
STEP 2 – INTERWORKING WITH OTHER ECOSYSTEMS

The GSMA is preparing a key management procedure to exchange key material between GSMA members and possibly extending trust to other secure domains such as FCC governed STIR/SHAKEN



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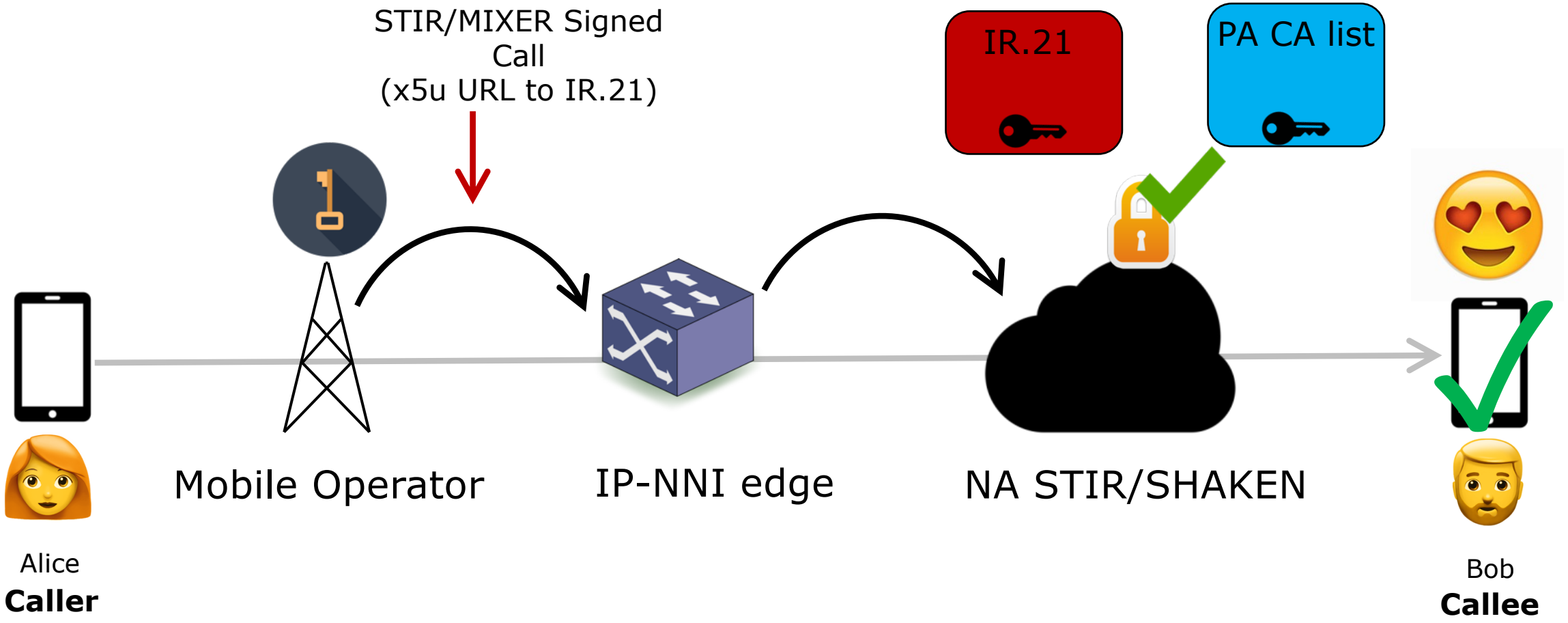
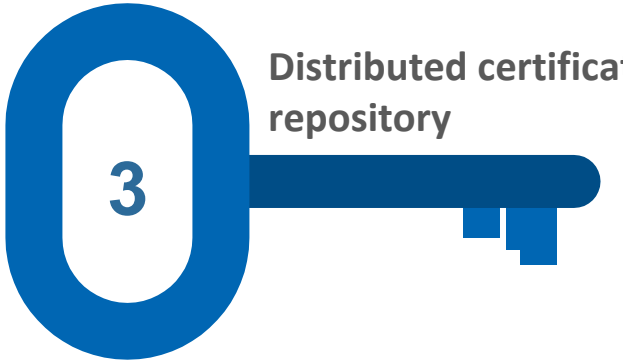
STIR/MIXER



Path 1: “x5u” URL points to a publicly available STI-CR

Path 2: “x5u” URL points to IR.21 service at IP-NNI edge (a “trust proxy”)

STEP 3 – DISTRIBUTED CERTIFICATE REPOSITORY



- Operators and other players to store key material (certificates) in a repository in the IPX network
- Maximizes automation and avoids manual mistakes
- This may be accomplished with DNS or just a plain web server

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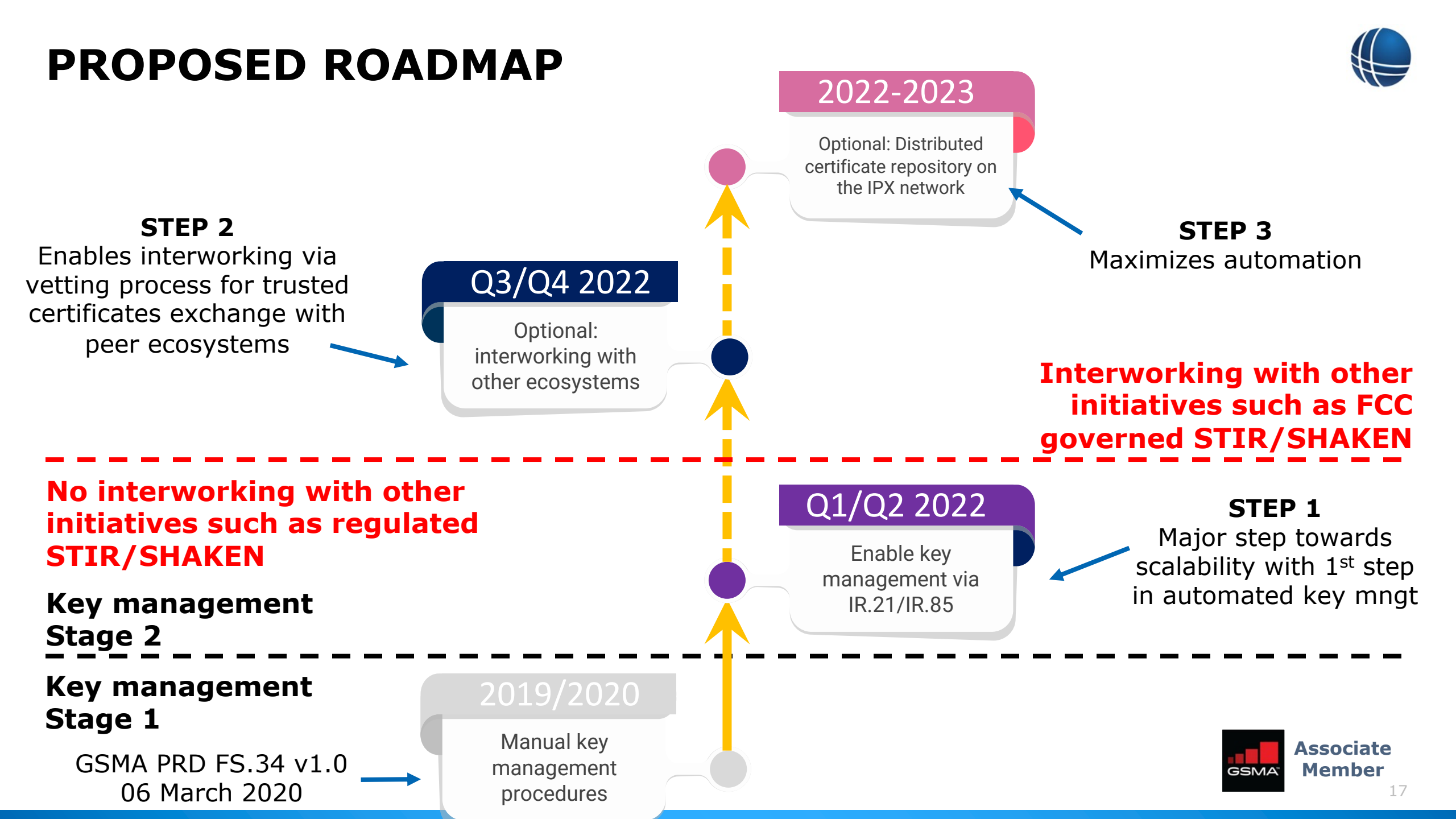
PROPOSED ROADMAP



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www.netnumber.com

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