3GPP SA3 - 5G SECURITY

Major changes in 5G security architecture and procedures | Sander de Kievit

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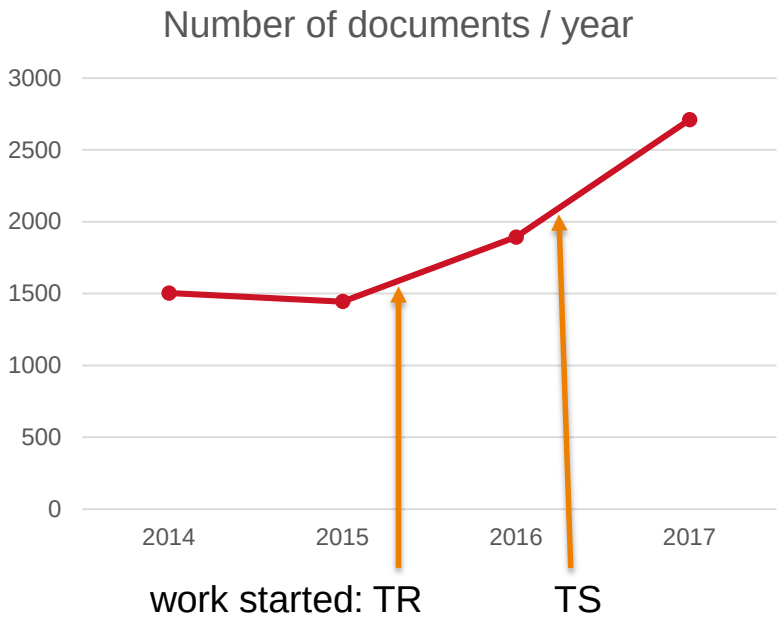
3GPP SA3 SECURITY WORKING GROUP

- SA3 is the working group tasked with security and privacy within the scope of 3GPP.
- Study started at #83 with TR 33.899
  - Overall topics identified
  - Priorities set
- Specification work started at #86-BIS
  - New spec: TS 33.501
  - First approved version (15.0.0) available soon
  - Result of ‘phase-1’ work



MAJOR CHANGES IN 5G – AUTHENTICATION

- **Design Goals:**
  - Unified authentication framework for both 3GPP and non-3GPP access
  - Improved control by home network

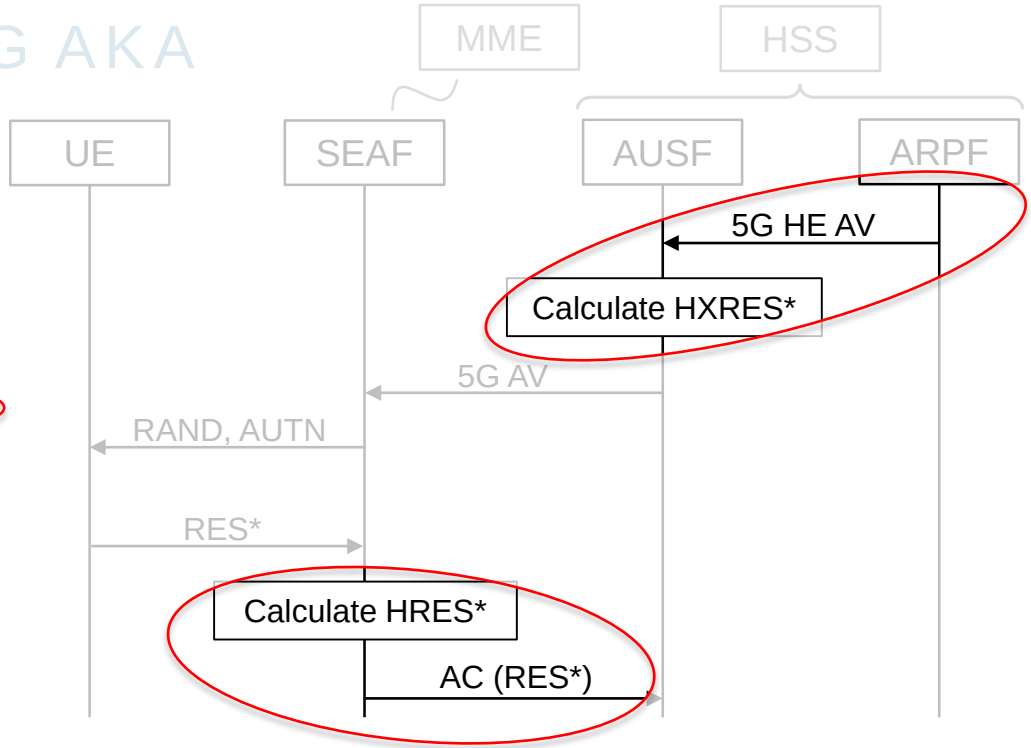
- **Design Questions:**
  - How to deal with potentially different transport of NAS and EAP?
  - How to add home control to EPS AKA?
  - Authentication algorithm under control of 3GPP SA3?

- **Final design decisions:**
  - Both EAP AKA' and newly developed 5G AKA supported
  - Continued compatibility with Rel-8 USIM

MAJOR CHANGES IN 5G – AUTHENTICATION

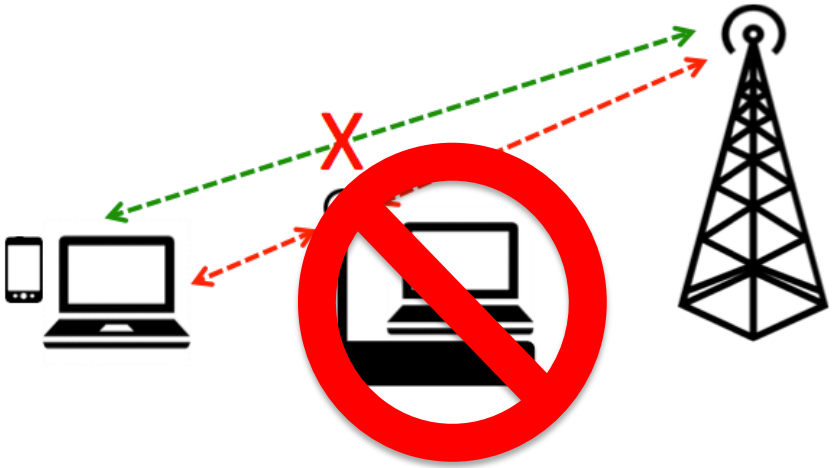
HOME CONTROL IN 5G AKA

- Based on EPS AKA
  - New authentication confirmation
  - New RES* and H(X)RES*
- Calculation of RES*:
  - KDF(CK, IK, SN name, RAND, RES)
  - Calculated in ARPF and UE
- Calculation of HRES*:
  - HASH(RAND, RES*)
  - Calculated in SEAF and AUSF
  - Used for authentication by the SEAF



MAJOR CHANGES IN 5G – SUBSCRIBER PRIVACY

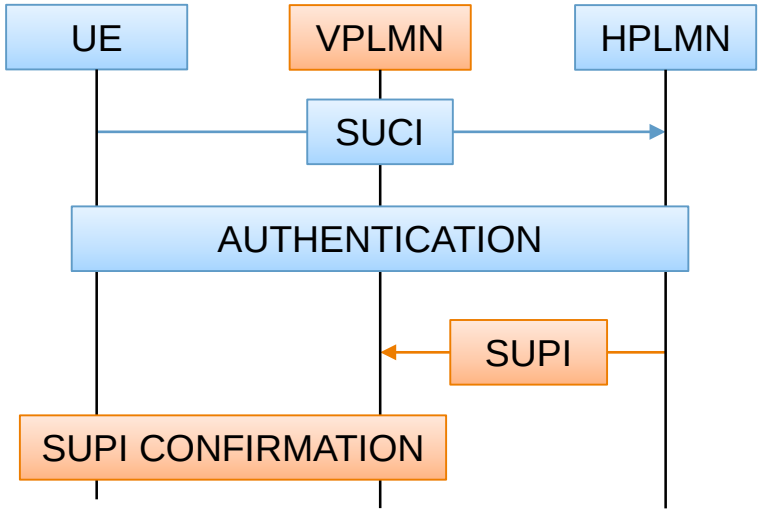
- **Design Goal:**
  - Defeating the IMSI catcher
- **Design Challenges:**
  - Scalable solution under control of operator
  - Comply with regulations



MAJOR CHANGES IN 5G – SUBSCRIBER PRIVACY

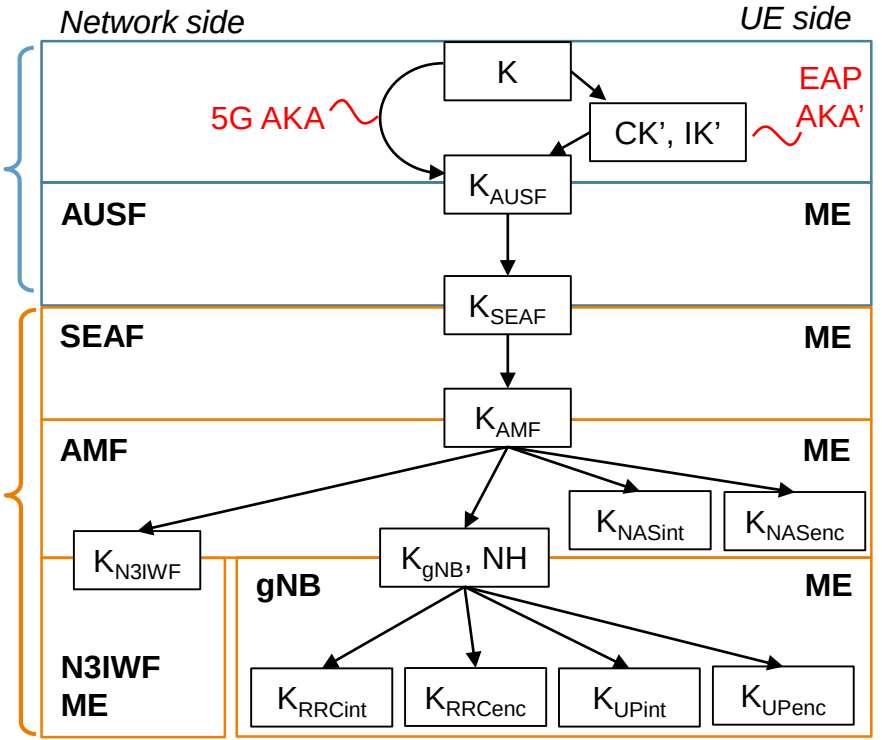
- **Solution:**
  - SUPI encrypted with home network public key on initial attach (SUCI)
  - Complete authentication
  - Then, send SUPI from HPLMN to VPLMN
  - Finally, confirm SUPI by binding into a key

- **Further details:**
  - Encryption can done on UE or USIM
  - Two algorithms standardized on UE side
  - Algorithms on the USIM can be controlled by operators



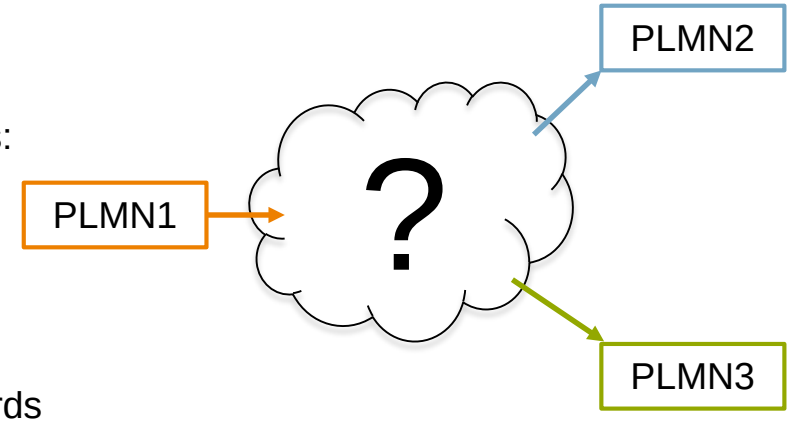
MAJOR CHANGES IN 5G – KEY HIERARCHY

- Key hierarchy extended to also include:
  - K_{AUSF} at home network
  - K_{SEAF} at serving network
- Reasons for K_{AUSF}:
  - Fast reauthentication
  - Protecting home to UE traffic, e.g. steering of roaming under discussion
- Reasons for K_{SEAF}:
  - Separate security anchor from mobility anchor
  - Pre-empts AMF at insecure locations



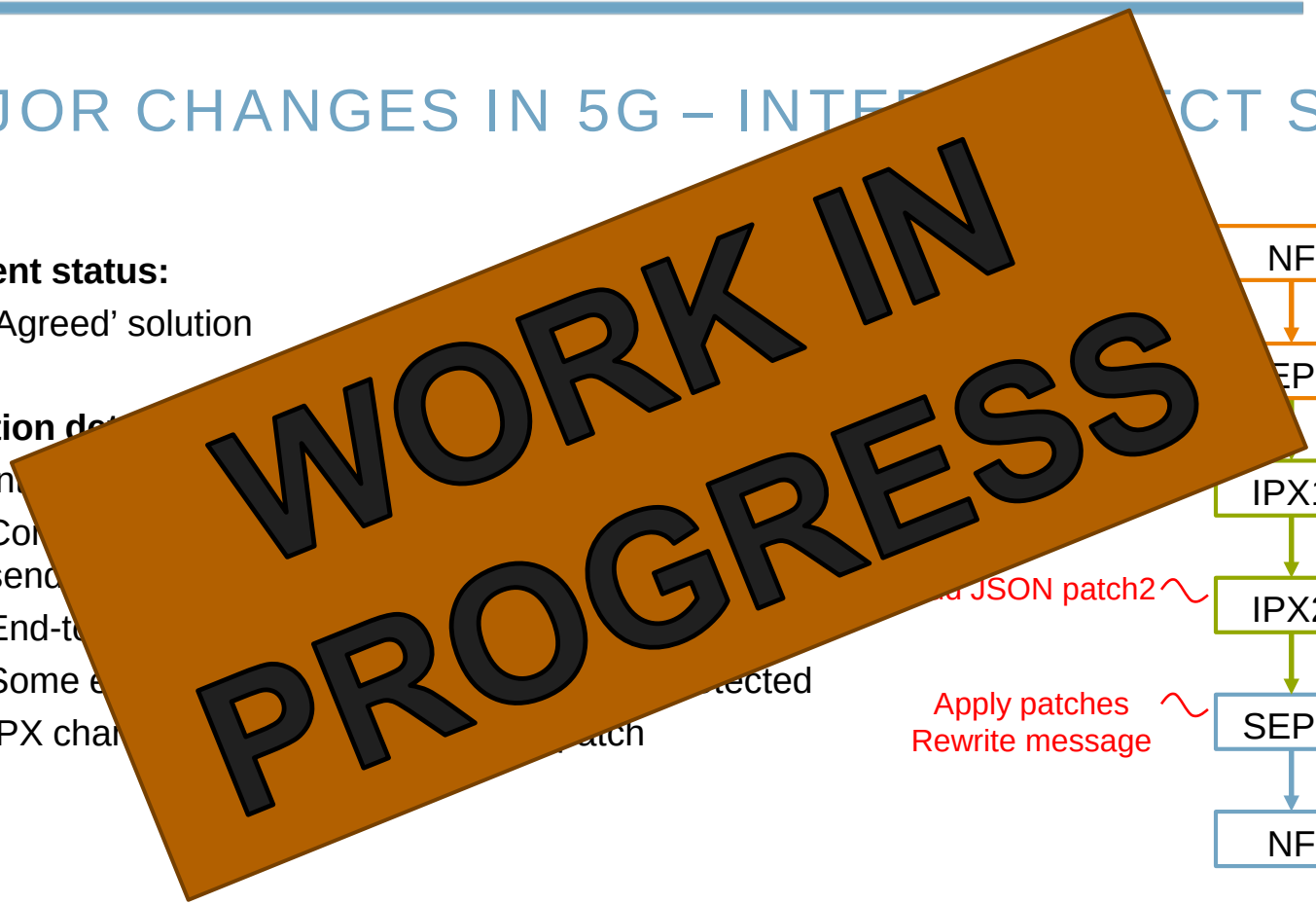
MAJOR CHANGES IN 5G – INTERCONNECT SEC.

- **Design Goal:**
  - Protecting messages exchanged between operators via the IPX network
- **Design Challenge:**
  - Deal with the complex services of IPX providers:
    - Rerouting of messages
    - Mediation of messages
    - Roaming hubs
  - Providing PLMN to PLMN security
  - Being compliant with JSON and HTTP2 standards



MAJOR CHANGES IN 5G – INTE… CT SEC.

- **Current status:**
  - ‘Agreed’ solution
- **Solution d…**
  - In…
  - Co… send…
  - End-t…
  - Some e… …tected
  - IPX cha… …atch



WHAT'S NEXT?

- Who can predict the future?
- What is going on / agreed?
  - Security of slice management interfaces
  - Security assurance of 5G NF
  - Authentication and key agreement services for 5G
    - Also known as GBA and BEST for 5G
  - Cellular IoT / massive MTC security in 5G
    - Bringing LTE IoT optimizations and more to 5G
  - Fixed Mobile Convergence
  - …

SUMMARY

- Specifications to be approved soon
- Major changes since 4G:
  - Unified authentication framework for both 3GPP and non-3GPP access
  - Extended key hierarchy for later security services
  - Improved subscriber identity confidentiality
  - Security of the interconnect network between operators
    - Work in progress…
- This is only the beginning. Phase-2 will add more!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