



Corporate Research – beyond current solutions

Facing changes in the Earth's climate, we must consider how we can improve the situation – all our contributions are important. As a technology supplier, Frequentis enables its customers to achieve CO₂ savings through indirect effects of existing and future products. In this way, we support high-level goals such as those defined by SESAR (Single European Sky ATM Research) aiming to contribute to a 10% CO₂ reduction target by reducing fuel burn by between 250 and 500 kg per flight by 2035 – corresponding to approximately one ton of CO₂ emissions per flight.

Having such goals in mind, our researchers investigate optimisations of critical processes in different domains, e.g. analysing the expansion of existing mechanisms to change aircraft sequencing and investigating how virtualisation of operations can increase flexibility while keeping safety and security at the highest level.

As researchers we rely on international co-operation, which is also a cornerstone of our work with respect to emergency service organisations: We help ensure that emergency calls issued by travellers abroad will be handled properly within internationally interconnected emergency networks. Being aware of the diversity of people who rely on public service being available 24/7, some of our staff started a private initiative to demonstrate and build a text-based emergency calling backend which made it into nationwide operation in Austria last year.

With our articles on ongoing research, we reach out to you, our customers, and partners. Our staff will be happy to conduct more detailed discussions on any of the topics presented in this bulletin.

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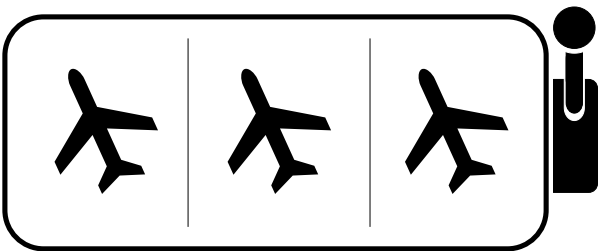
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SlotMachine - A Privacy-Preserving Marketplace for Slot Management

Author: Eduard Gringinger

The aviation industry is confronted with rising passenger numbers and increased flight volume in the face of limited resources at airports and in the air. At the same time, airlines struggle with increased cost pressure from an increasing number of market participants while the highest safety standards demand compliance with complex processes.

One promising area of optimisation is the allocation of Air Traffic Flow Management (ATFM) slots. ATFM slots are issued by the EUROCONTROL Network Manager in times of increased flight traffic, regulating time of departure, exact execution of the flight route, and time of landing. Until now, ATFM slots have only been subject to intra-airline swaps, used by airlines to prioritise expensive flights and thus minimise overall costs. Reasons for different costs of individual flights are, for example, the provisioning of connecting flights for passengers or work-time restrictions for crew members. Airlines want to keep the cost structure of their flights confidential, as they fear a competitive disadvantage when disclosed. This desire for confidentiality has hampered slot swapping between different airlines. SlotMachine will employ blockchain technology and secure multi-party computation to extend the existing User-Driven Prioritisation Process (UDDP) solution with the possibility to keep private the participating airlines' confidential information such as the cost structure of flights. Technology will allow for secure, auditable transactions without the need for a central broker, whereby stakeholders will be able to enter slot swapping transactions without disclosing information to other participants. By demonstrating the feasibility of a privacy-preserving platform for swapping ATFM slots, the foundation can be laid for the development of a product that will be an essential element in the aviation industry in the future. It contributes to better use of existing resources at airports, higher efficiency of airlines, lower emissions, and shorter delays for passengers.

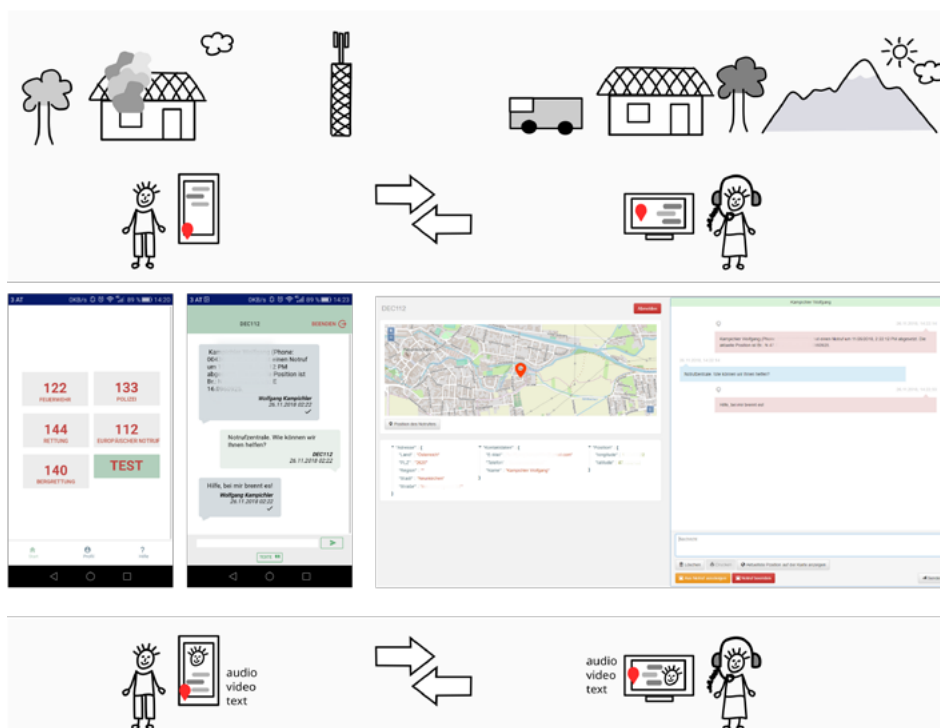


CELESTE

Author: Wolfgang Kampichler

Cross-border ESInet and LoST Hierarchy For Emergency Service Accessibility Testing, or CELESTE for short, is one project contributing to EENA's NG112 deployment initiative launched at the EENA conference in April 2019 (Dubrovnik, Croatia).

This project is led by Frequentis and aims to provide local or regional emergency service networks in Denmark, Italy and Austria that are interconnected to allow roaming with DEC112 or mobile VoIP clients. Industrial partners are B80 and GridGears, and the Austrian Regulator RTR GmbH acts as observer and technically supports the project as service host. In addition, control rooms from Denmark (Copenhagen Fire Department), Italy (Trento and Bolzano), and Austria (Leitstelle Tirol) are team members for testing and validation. Perhaps this is the very first time where national emergency service networks (NG112) are in use and internationally interconnected. The main use case is to demonstrate a roaming scenario in which, for example, a person from Austria is travelling to Italy and emergency calls or DEC112 chats are still forwarded to the proper control room, which, when the Austrian person is in Italy, is an Italian control room. This requires extended capabilities in terms of mapping a location to the appropriate control room that are implemented in a so called 'Forest Guide'. In simple terms, a 'Forest Guide' knows about authoritative mapping services available in each country and redirects a requesting entity to the right point. In addition, core elements that do the actual forwarding of signalling messages need to know and trust each other based on certain peering agreements. Finally, this project also demonstrates the advantage of standardised interfaces (see Frequentis sets Standards) as functional elements of three different vendors are interconnected. Moreover, as there is one project partner who is engaged with regulatory issues, the project results also contribute to regulation topics.



SESAR Virtual Centre concept @ next level

Author: Michael Poiger



Today, Air Traffic Management in Europe mostly consists of country-based systems and processes, which require customised systems and solutions at each ATM provider. This has led inevitably to a lack of interoperability and higher costs for air navigation services across Europe and an inefficient usage of resources. This is one of the major findings of the Airspace Architecture Study.

After extensive research and validations were conducted within the framework of the virtual centre project (PJ.16.03 and PJ15.09) by SESAR

Joint Undertaking Members and partners, namely COOPANS, DFS, DSNA, Enaire, ENAV, Eurocontrol, Frequentis, HungaroControl, Indra, Leonardo, LPS SR, NATS, SINTEF, Skyguide, Thales, and Air Navigation Services of the Czech Republic, operational and technical solutions were developed to address this demand of optimised resource usage, cost efficiency and service continuity.

On 16 October 2019, during the SESAR (Single European Sky ATM Research) Virtual Centre Executive Day in Vienna hosted by Frequentis, the results to improve this situation by mapping the operational needs such as rationalisation of infrastructure, delegation of airspace, and contingency on interoperable infrastructures were demonstrated at nine European sites and the Frequentis headquarters.

In addition, the complexity was increased as many different project partners participated, the live demonstration comprised a step-by-step takeover of air navigation services sectors – the remote management from a remote air traffic control centre of another air navigation service provider - which can also be used as a fallback solution.

Due to the importance of communication between the centres to perform the operational procedures and the interoperability of the systems, Frequentis supported the design of the operational procedures using the Frequentis aware method (Control Room Consulting) and supported these operational procedures with the Frequentis Voice Communication System based on a service-oriented architecture and a SWIM Broker, ensuring the data exchange between the individual partners, strengthening the maturity of the virtual centre concept for the future use.



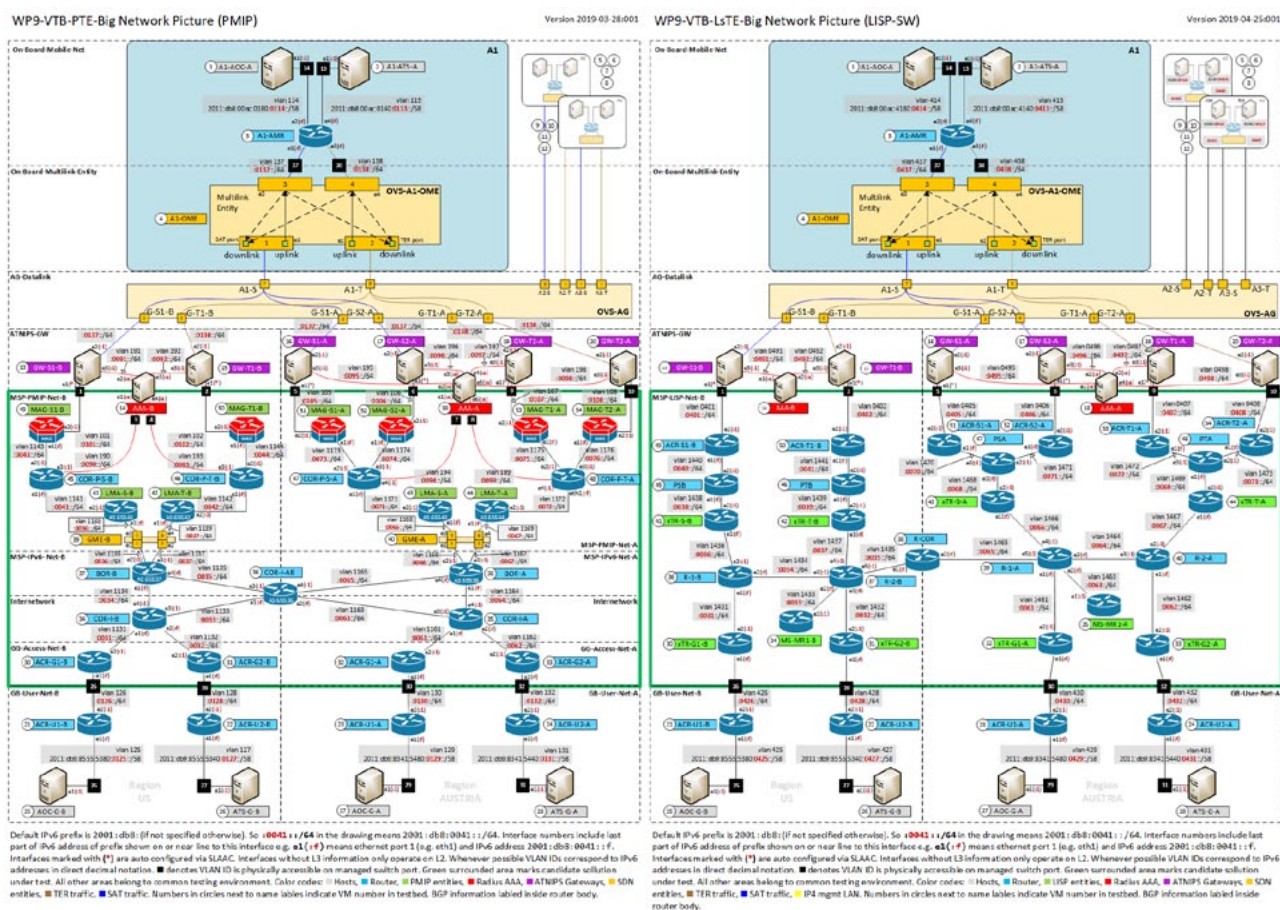
A virtual world to evaluate IPv6-based mobility solutions for ATM – the results:

Authors: Richard Prinz, Hubert Kuenig, Saadan Ansari



In 2017, Inmarsat UK awarded Frequentis Corporate Research Contract to develop ‘a virtual global ATM environment’ for verifying and validating the future IPv6-based mobility and multilink concepts for satellite-based communications in ATM under ESA ARTES 4.0 Iris Satcom Global Solution¹⁾ in close coordination with leading stakeholders (EC, SESAR JU/DM, EASA and EUROCONTROL). In Research Bulletin 2017²⁾ we reported on that and now, after conducting many test-runs, the final verification results have been presented at a combined session of AEEC³⁾ and ESA.

Figure 1 - IRIS ‘virtual world’ - the big picture



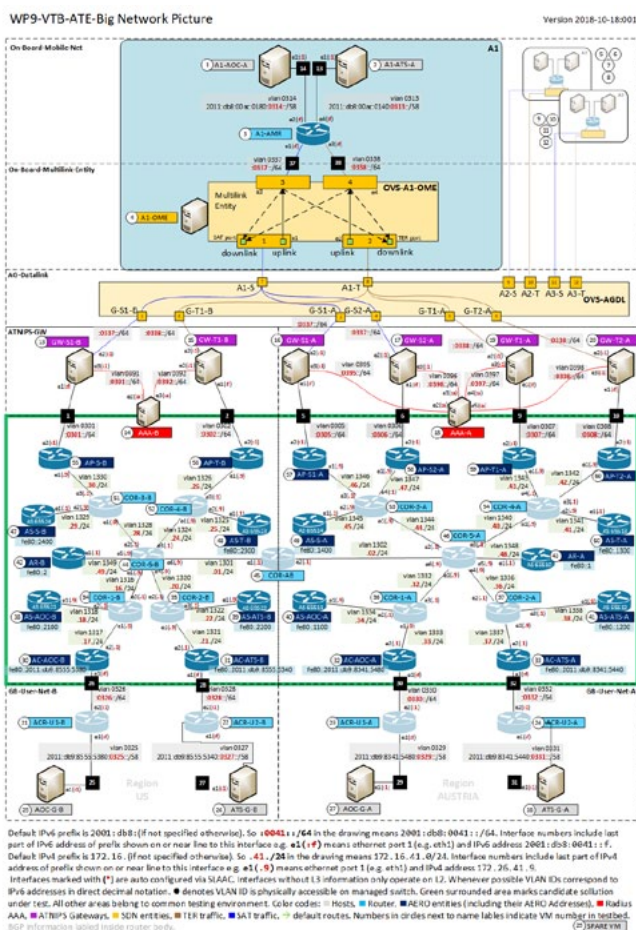
The solution candidates Proxy Mobile IPv6 (PMIP)⁴, Locator/Identifier Separation Protocol (LISP)⁵ and Asymmetric Extended Route Optimization (AERO)⁶ were evaluated with respect to suitability for the mobility and multilink requirements in an Internet Protocol Suite (ATN/IPS)-based future Aeronautical Telecommunication Network leveraging terrestrial as well as satellite ATM communications.

The validation campaigns were conducted on a modular test-bed emulating a global ATM environment comprising ~200 virtual machines and ~30 routers utilizing COTS devices and open-source components. A single Common Testing Environment representing multiple aircraft, satellite A/G data links and ground-based infrastructure ensured that the target candidate solutions are validated under the same constraints and conditions.

Use cases tested include multiple aircraft flying over multiple regions using heterogenous communication technologies based on their simulated availability and operational preferences.

Results show that there is no single solution that fits all requirements; each of them has its own advantages and disadvantages. But results also show that, by some clever combination of existing solutions and new concepts like Software Defined Networking (SDN), a workable solution is within reach.

Frequentis as a globally recognised driving force in ATN/IPS will continue setting standards – so stay tuned for more to come.



1 <https://artes.esa.int/iris>

2 CR-Bulletin-2017: A virtual world to evaluate IPv6 based mobility solutions for ATM

3 <https://www.aviation-ia.com/activities/aec>

4 https://en.wikipedia.org/wiki/Proxy_Mobile_IPv6

5 https://en.wikipedia.org/wiki/Locator/Identifier_Separation_Protocol

6 <https://tools.ietf.org/html/draft-templin-intarea-6706bis-17>

Text-based emergency calling V2.0

Author: Richard Prinz



Back in 2015 a group of Frequentis employees started the private DEC112 (Deaf Emergency Call - 112)¹⁾ to provide the deaf and hearing-impaired community better access to emergency services. The situation in Austria (as well as in the vast majority of other countries) then was (and still is) far from optimal, requiring such people to send SMS/FAX messages or emails which get processed by different organisations until they eventually reach the correct control centre. Needless to say, this process is highly inefficient, wasting valuable time.

The DEC112 solution provides text-based emergency chat services including current location and arbitrary additional information (like health data) sent from an easy-to-use DEC112 mobile-app to the responsible control room based on the user's current location. A simple and yet flexible control room interface to DEC112 services allows easy integration of different vendors and systems. This reduces costs and thus increases control centre operators' acceptance of DEC112.

The DEC112-Project received funding in 2017 and again in 2019 from the Austrian start-up funding organisation Netidee²⁾ and has also been generously supported by Frequentis since its inception. Meanwhile DEC112 has been deployed in Austria nationwide with hundreds of registered users, some of whom may already have been saved by DEC112. It has also resulted in interesting international follow-up projects like EENA's NG112 Project (also in this issue) where the DEC112 concepts are tested in a multinational environment.

The official, old SMS/FAX and email-based solution in Austria still exists but upcoming standards, already implemented by DEC112 and driven by Frequentis, are a foundation to convince decision-makers to consider text-based emergency calls in legislation and regulation to be used not only within the deaf and hearing-impaired community, but also by everyone.



Figure 1 - DEC112 used by Emergency NorthEast ³⁾

1) <https://www.dec112.at/>

2) <https://www.netidee.at/>

3) Emergency NorthEast (Notruf Niederösterreich) is the emergency organization responsible for Austria's largest state Lower-Austria
<https://notrufnoe.com/>

FREQUENTIS sets standards

Author: Wolfgang Kampichler



In the second year of our ETSI membership we are happy to announce that an important technical specification (TS 103 479) has been finalised and published by ETSI SC EMTEL (Special Committee Emergency Telecommunication).

Frequentis Corporate Research was contributing to TS 103 479 as Rapporteur (being responsible for the Work Item, acting as the prime contact point on technical matters and for information on progress throughout the drafting phase). What is TS 103 479? Basically, the TS defines core services of an emergency service network to support next-generation emergency calling (commonly known as NG112 or NG9-1-1). Such core services provide facilities that support centralised mapping and routing functions for current and future emergency communications. The baseline is functional elements that comprise the required security measures and routing capabilities being necessary to route emergency calls to the responsible control room based on the caller's location. In addition, other protocols and procedures are specified to allow multimedia communications as they evolve. This is an important milestone on the way toward the implementation and deployment of NG112 in Europe: as of now our public safety customers may refer to an official standard in their procurement activities. Our standardisation work within SC EMTEL continues with two more Work Items led by Frequentis. The first one, TS 103 480, covers interoperability and conformance testing of core services of an emergency service network. Generally, this TS supplements TS 103 479 and defines test configurations and mandatory test scenarios to proof interoperability and conformance of functional elements. The second one, TS 103 698, specifies a Lightweight Messaging Protocol for Emergency Service Accessibility that is already implemented in the Austrian DEC112 project.



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