NetSat Day

Toulouse Space Show 2018 associated event

Thursday the 28th of June – Room Ariane – Level 1

8am30 – 8am50	Toulouse Space Show Registration	
8am50 – 9am00	NetSat Day Welcome Introduction	
9am00 – 9am30	**Keynote #1 : Cédric BAUDOIN (Thales Alenia Space)**	
9am30 – 10am20	RESOURCE MANAGEMENT SESSION (#1)	
	9 am30 10am00	**Optimization of resource management** *Benoit GARNIER (Thales Alenia Space)*
	10am00 10am20	**Satellite access network planning and control** *Ahmad AL SHEIKH (QoS Design)*
10am20 – 11am00	Demo and coffee break	
11am00 – 11am40	RESOURCE MANAGEMENT SESSION (#2)	
	11am00 11am20	**Two-Colour Scheme for A Multi-Beam Satellite Return Link: Impact of Interference Coordination** *Yoann COUBLE (TéSA/IRIT)* Partners : TéSA/IRIT, Thales Alenia Space, CNES
	11am20 11am40	**Adaptive load control for IoT based on satellite communications** *Hugo CHELLE (Airbus Defense and Space)* Partners : IRIT, Airbus Defense and Space
11am40 – 12pm20	TRANSPORT SESSION	
	11am40 12pm00	**TCP BBR and SATCOM** *Guillaume COLOMBO (CNES)*
	12pm00 12pm20	**Impact of Delayed Acknowledgment on TCP performance over LEO satellite constellations** *Bastien TAURAN (TéSA/ISAE)* Partners : TéSA/ISAE, Thales Alenia Space, CNES
12pm20 – 2pm00	LUNCH BREAK	
2pm00 – 2pm30	**Keynote #2 : Gorry FAIRHURST (University of Aberdeen)**	
2pm30 – 3pm20	TRAFFIC ENCRYPTION AND QOS SESSION	
	2pm30 3pm00	**DPI-based QoS architecture** *David PRADAS (Viveris Technologies), Fannia PACHECO (UPPA), Mathieu GINESTE (Thales Alenia Space)* Partners: Thales Alenia Space, Viveris Technologies, UPPA
	3pm00 3pm20	**Classification techniques for the management of the "Quality of Service" in satellite communication systems** *Fannia PACHECO (UPPA)* Partners: UPPA, Thales Alenia Space
3pm20 – 3pm30	**SUNRISE project at IRT**	
	Olivier GREMILLET and Jacques DECROIX (IRT Saint-Exupéry) Partners: IRT Saint-Exupéry, Airbus DS, Thales Alenia Space, Viveris Technologies Support: CNES, LAAS + newcomers.	
3pm30 – 4pm00	Demo and coffee break	
4pm00 – 5pm30	HYBRIDIZATION AND CONVERGENCE SESSION	
	4pm00 4pm40	**New multimedia transport standards in a SATCOM context** *Renaud SALLANTIN (Thales Alenia Space), David FERNANDES (Viveris Technologies) and Raffaello SECCHI (University of Aberdeen)* Partners: Thales Alenia Space, University of Aberdeen, Viveris Technologies
	4pm40 5pm10	**Traffic engineering and dynamic re-routing** *Fabrice ARNAL (Thales Alenia Space) and Joaquin MUGUERZA (Viveris Technologies)* Partners: Thales Alenia Space, TéSA, Viveris Technologies
	5pm10 5pm30	**Improving content delivery with size-aware routing in hybrid satellite / terrestrial networks** *Elie BOUTTIER (TéSA/IRIT)* Partners : TéSA/IRIT, Thales Alenia Space, CNES
5pm30 – 5pm45	Conclusive interactions	

| 8am30 – 8am50 | **Toulouse Space Show Registration** |

| 8am50 – 9am00 | **NetSat Day Welcome Introduction** |

| 9am00 – 9am30 | **KEYNOTE #1: Cédric BAUDOIN** |

9am30 – 10am20 – RESOURCE MANAGEMENT SESSION #1

- **9am30 – 10am00 "Optimization of resource management"**
  Benoit GARNIER (Thales Alenia Space)

The objective of this study is to improve the usage of spectral resource in SATCOM systems. The main contributions are the formalization of the possibilities of coupling access-flexibility in the form of a optimization problem and the proposal of a rapid resolution method to optimize the capacity. "Smart diversity" schemes have also been proposed, taking advantage of the edge flexibility to optimize the cost of deploying a multi-gateway system. These schemas reduce the price of redundancy by sharing it among several Gateways. The capacity of an N + 1 system (including N Gateways used plus 1 of redundancy) has been estimated using accurate modelling of attenuation. The results show that a very good availability (greater than 99.9 +%) can be achieved with a simple decision metric. Possibilities of software evolution are envisaged, in particular to include the schemas of the type smart diversity, in order to compare them to the N + P scheme.

- **10am00 – 10am20 "Satellite access network planning and control"**
  Ahmad AL SHEIKH (QoS Design)

NEST Satellite provides powerful tools for planning and optimizing DVB-RCS2 satellite access networks. It is the outcome of the collaboration between QoS Design and Thales Alenia Space. NEST Satellite allows simulating and optimizing a satellite access network by importing the associated topology and traffic measurements from the DVB-NMS and the deployed IPFIX probes, respectively. It allows completing the topology with additional elements such as DVB-Hubs, satellite links and trunks, subscriber VSATs, and even integrating user-defined traffic (e.g. forecast). It allows validating new configuration strategies before deploying it on the real system, and evaluating its impact on the perceived QoS. This performance evaluation also allows determining if the actual configuration is suitable to handle new subscriber VSATs and ensure acceptable performances under fading conditions.

| 10am20 – 11am00 | **DEMO AND COFFEE BREAK** |

11am00 – 11am40 – RESOURCE MANAGEMENT SESSION #2

- **11am00 – 11am20 "Two-Colour Scheme for A Multi-Beam Satellite Return Link: Impact of Interference Coordination"**
  Yoann COUBLE (TéSA/IRIT)
  Partners: TéSA/IRIT, Thales Alenia Space, CNES

The return link of broadband satellite systems has recently received more attention due to the spread of multi-beam antennas which enable spatial frequency reuse, and thus increased drastically the number of users that can potentially be served by one satellite. While interference isolation has so far been the way to go, with regular four-color frequency reuse scheme, there is a growing interest in densifying the frequency usage as is being done in cellular networks. In this paper we address the return link radio resource allocation challenges, from spectral resource allocation to user scheduling including modulation and coding scheme (MODCOD) selection. We first consider the possibility to use a two-color scheme, while keeping a local MODCOD selection process and we show that even though it yields a potential performance gain (+16 %) with respect to the state-of-the art (SoA), it is not viable due to a very high decoding failures rate. Therefore, we propose a simple - yet fast and efficient - coordinated MODCOD selection process that alleviates the need of estimating interference and reduces drastically decoding failures. This coordination step offers extremely promising gains (+58 %) over the SoA, and moreover leaves the per beam scheduler unchanged. Finally, to assess the potential gains of coordinated scheduling, we formulate a joint user scheduling and MODCOD selection problem across all beams. We propose an offline heuristic to solve it efficiently and obtain a 77\% gain wrt the SoA, implying that even higher gains can be reached through interference coordination. Our contributions highlight the potential gains of a two-color scheme and shed light on several levers to reap its benefits through interference management.

- **11am20 – 11am40 "Adaptive load control for IoT based on satellite communications"**
  Hugo CHELLE (Airbus Defense and Space)
  Partners: IRIT, Airbus Defense and Space

The Internet of Things (IoT) market grows more and more every year. Today, the number of IoT devices is estimated around 8 billion but forecasts announce 20 billion devices for 2020. Terrestrial or satellites communications systems are already deployed to answer the connectivity need. The overload on the random access channel is an issue since it may cause service outage. Within the Narrow Band IoT, created by the Third Generation Partnership (3GPP), the Access Class Barring (ACB) is the load control mechanism. Unfortunately, the 3GPP did not specify a method to compute the load control parameters. In this paper, in the context of a satellite IoT communication system using a satellite random access method. We propose a method to compute dynamically ACB based load control parameters. Thanks to our method, the load control mechanism reaches excellent results regarding transmission reliability and energy consumption for various traffic scenarios.

- **11am40 – 12am00 "TCP BBR and SATCOM"**
  Guillaume COLOMBO (CNES)

BBR (Bottleneck Bandwidth and Round-trip propagation time) is a new congestion control developed at Google. Already deployed at Google (Youtube video servers, google servers, Google Cloud Platform, B4), BBR relies on two main phases: a probing phase and a data sending phase. Being rate-based, BBR exploits acknowledgements to estimate the bottleneck bandwidth and the round-trip propagation time. BBR aims for a fully used bottleneck bandwidth while keeping the bottleneck buffer empty, maximizing the throughput while minimizing the delay. This presentation provides the early results of several experimentations where BBR is used in the context of a satellite communication either emulated or real. The evaluation considers throughput, queue state, packet loss and fairness. On one hand BBR shows interesting trade-off between link occupancy and queueing delay. On the other hand, some issues such as late-comer fairness and fairness with others congestion control were observed.

- **12am00 – 12am20 "Impact of Delayed Acknowledgment on TCP performance over LEO satellite constellations"**
  Bastien TAURAN (TéSA/ISAE)
  Partners: TéSA/ISAE, Thales Alenia Space, CNES

This presentation aims at quantifying the impact of a default TCP option, known as Delayed Acknowledgment (DelAck), in the context of LEO satellite constellations. Satellite transmissions can suffer from high channel impairments, especially on the link between a satellite and a ground gateway. To cope with these errors, physical and link layer reliability schemes have been introduced, at the price of an increase of the end-to-end delay seen by the transport layer (e.g. TCP). Although DelAck is used to decrease the feedback path load and for overall system performance, the use of this option conjointly with satellite link layer recovery schemes might increase the delay and might be counterproductive. To assess the impact of this option, we drive simulation measurements with two well-deployed TCP variants. The results show that the performance gain depends on the variant used and that this option should be carefully set or disabled as a function of the network characteristics. DelAck has a negative impact on TCP variants which are more aggressive such as TCP Hybla, and should be disabled for these versions. However, it shows benefits for TCP variants less aggressive such as NewReno.

12pm20 – 2pm00   LUNCH BREAK

2pm00 – 2pm30   KEYNOTE #2: Gorry FAIRHURST

- **2pm30 – 3pm00 "DPI-based QoS architecture"**
  David PRADAS (Viveris Technologies), Fannia PACHECO (UPPA), Mathieu GINESTE (Thales Alenia Space)
  Partners: Thales Alenia Space, Viveris Technologies, UPPA

The study has allowed to prove that a satcom QoS architecture based on DPI (and/or machine Learning) techniques allow not only to answer the problem of flow identification and packet marking for a network post-treatment (such as traffic priority, filtering of content, security purposes, commercial purposes, traffic prediction, pricing, etc.), but also for adapting the DAMA resource allocation of the return link for real time flows such as VoIP/Videoconference. Regarding the DAMA adaptation, the new architecture has proved to obtain similar performances than the OpenIMS architecture. Even if OpenIMS seems to be more accurate when detecting the end of RTP flows (since it is based on SIP detection messages), the new architecture could reach the same level of accuracy with some minor modifications.

- **3pm00 – 3pm20 "Classification techniques for the management of the "Quality of Service" in satellite communication systems"**
  Fannia PACHECO (UPPA)
  Partners: UPPA, Thales Alenia Space

Traffic analysis stands for all the strategies intended to find relationships, patterns, anomalies, and misconfigurations, among others things, in Internet traffic; particularly, traffic classification is a subgroup of strategies in this field. Recently, traffic classification has become a challenging task due to the widespread of new technologies, such as traffic encryption and encapsulation, which intricate or unable classical traffic classification strategies. Machine Learning (ML) emerges as a new direction in this field, showing signs of future success, such as knowledge extraction from encrypted traffic and more accurate Quality of Service management. In the present work, we study the whole process needed to perform traffic analysis with ML. We identified the main problematics found in the literature as well as in experimental tests in order to define some strategies to fill these gaps. The ML process starts by extracting information from historical data, several features that characterize the problem are computed and used to build ML models that can classify or predict the status of the case study. One of the main obstacles, for applying ML in this domain, is the unavailability of knowledge base that serves as primordial resource for building ML solutions. This knowledge base is set up with a variety of traffic that defines the interactions between the Internet network actors. In this sense, we propose a cloud platform in order to emulate and to record Internet traffic; moreover, this platform will allow defining an experimental setup for testing the ML solutions. Following, the features extracted from the Internet network play a key factor for the success of the ML models. We study several approaches for performing feature extraction, where the statistical based features seem to be the most effective ones. Considering that these features suffer from some drawbacks related to the distribution of the traffic type (streaming, web content, etc), we present a novel approach to perform the feature extraction process. Another additional challenging task found was the dynamicity of the Internet network leading to rapid obsolescence of the ML solutions. This problem is faced with an incremental learning approach that can help to increase the base knowledge acquired, and to update the ML models regularly. Each of the

previous steps will be part of a main architecture that will handle the traffic analysis in an autonomic way. This autonomic system aims at adapting and configuring itself given the current status of the network.

3pm20 – 3pm30 – SUNRISE project at IRT

- **3pm20 – 3pm30 "SUNRISE project at IRT"**
Olivier GREMILLET and Jacques DECROIX (IRT Saint Exupéry)
Partners: IRT Saint Exupéry, Airbus DS, Thales Alenia Space, Viveris Technologies
Support: CNES, LAAS

SUNRISE is a project that IRT Saint-Exupery was planning during the last 6 months and is in its final elaboration phase. The following research topics will be tackled: integration of satellite into the 5G, realization of a SDN (Software Defined Networking)/NFV (Network Function Virtualization) platform to virtualize Satcom network functions, exhibition of benefits of VPP (Vector Packet Processing) for satellite functions, support to the standardization. As a follower of the former IRT project ALBS, the consortium will include the same members Airbus DS, Thales Alenia Space, Viveris Technologie with some new comers (the consortium is still open). The main objectives of this project will be presented in this talk.

3pm30 – 4pm00   DEMO AND COFFEE BREAK

4pm00 – 5pm30 – HYBRIDIZATION AND CONVERGENCE SESSION

- **4pm00 – 4pm40 "New multimedia transport standards in a SATCOM context"**
Renaud SALLANTIN (Thales Alenia Space), David FERNANDES (Viveris Technologies) and Raffaello SECCHI (University of Aberdeen)
Partners: Thales Alenia Space, University of Aberdeen, Viveris Technologies

While broadcasting services are currently the dominant source of revenue for satellite operators, an increasing demand for customised video has been anticipated to lead to an important change in the way satellite capacity is used. The trend towards on-demand content is propelled by Internet progressive streaming, whose proportion of traffic sees a year-by-year increase. Dynamic Adaptive Streaming over HTTP (DASH) has emerged as a transport for IP-based on-demand unicast streaming. DASH divides multimedia content into chunks that are encoded at a range of qualities. Clients use these chunks to implements an algorithm that dynamically adapts the transmission rate throughout a session, making it suitable for use in contexts such as the Internet, where capacity cannot be guaranteed and resources must be shared. The success of DASH is clearly demonstrated by a wide base of industry support and its widespread availability in end systems. This presentation investigates methods to integrate DASH video with the satcom environment, seeking to maintain high levels of end-user Quality of Experience (QoE) and satellite performance. This creates a scenario were video streaming applications operate independently from the satellite transport platform (known as an Over-The-Top service). There are also opportunities for a convergence of Broadband and Broadcast services, where the satellite platform becomes an integral part of the video delivery infrastructure, offering tools both to access video contents and enhance performance. Our results using OpenBach emulation platform show the potential of DASH-based video streaming solutions in both unicast and converged scenarios.

- **4pm40 – 5pm10 "Traffic engineering and dynamic re-routing"**
Fabrice ARNAL (Thales Alenia Space) and Joaquin MUGUERZA (Viveris Technologies)
Partners: Thales Alenia Space, TéSA, Viveris Technologies

We evaluated MPTCP performance for two well-differentiated scenarios (an "end-to-end scenario" and a "proxy scenario") where a client and a server were linked by multiple paths, one of which was a satellite link. Since the use of PEP proxies to speed up TCP traffic is common on such links, we have also studied the compatibility and impact of using the MPTCP protocol in a network topology containing PEPs (PEPSal). For the "proxy scenario", we therefore have to implement a PEP / MPTCP proxy, and for the "end-to-end scenario", two sub-scenarios have been defined: one with PEP and the other without PEP on the satellite link.

- **5pm10 – 5pm30 "Improving content delivery with size-aware routing in hybrid satellite / terrestrial networks"**
Elie BOUTTIER (TéSA/IRIT)
Partners: TéSA/IRIT, Thales Alenia Space, CNES

As Internet usages expand quickly, access networks are modernized with new technologies like fiber-optic communications. However, upgrade costs are prohibitive in sparsely populated areas, the latter turning notably towards satellite connection. Indeed, this technology allows deploying a high-throughput Internet access quickly in these regions. Nevertheless, GEO satellites induce a long delay, not experienced on terrestrial infrastructures despite their low throughput. In this paper, we consider a heterogeneous network with both a satellite and a terrestrial path. This kind of architecture is known to be difficult to operate because of the important differences between used technologies. The emerging MP-TCP transport protocol, whose design enables to aggregate disparate paths properly, brought new hopes for heterogeneous networks. However, it does not take user Quality of Experience (QoE) into account as it focuses on maximizing the links occupancy. This presentation proposes an intelligent path selector using the content size to maximize users QoE in heterogeneous networks. Before detailing this method, we describe the architecture able to retrieve the size of delivered contents thanks to Content Delivery Network Interconnection (CDNI). Finally, we implement a testbed to evaluate the behavior of the proposed routing method. The results show a significant improvement of the delivery performance, outperforming MP-TCP.

5pm30 – 5pm45   Conclusive interactions