



## InSecTT Newsletter October 2021



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# Welcome!

This is the **October 2021 edition** of the InSecTT newsletter, highlighting news & achievements from InSecTT during Q3 2021.

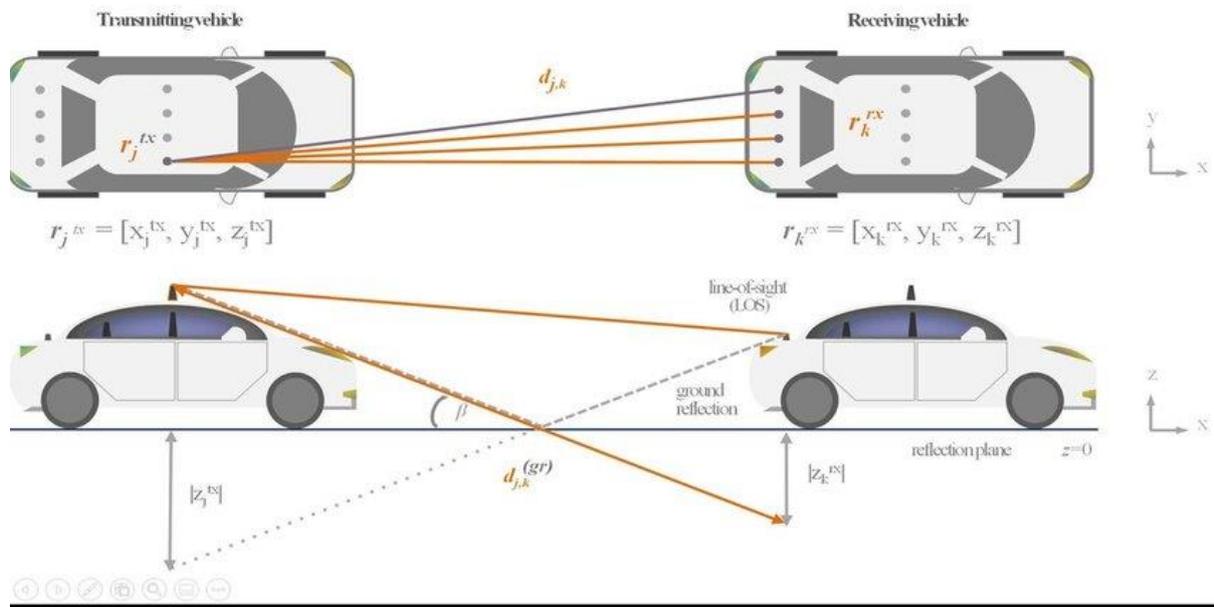
Please distribute this newsletter to all interested parties in your organization. We appreciate your feedback, please send comments or requests to [Insectt@v2c2.at](mailto:Insectt@v2c2.at).

Enjoy the reading!

## MIMO modelling

Sep 30, 2021

ISEP is involved in the modelling and performance improvement of multiple antenna systems or multiple input multiple output systems (MIMO) in two specific use cases: Wireless platooning and wireless avionics intra-communications. Work in task 3.2 targets tools for the realistic modelling of these type of system, including propagation modelling, multiple antenna signal processing schemes, beamforming techniques, direction of arrival estimation, source separation, as well as semi-blind signal processing based on tools such as parallel factor and independent component analysis. MIMO is expected to contribute towards the concept of real-time and ultra-low latency wireless networks exploiting channel diversity in space and time..



# Artificial Intelligence for communications

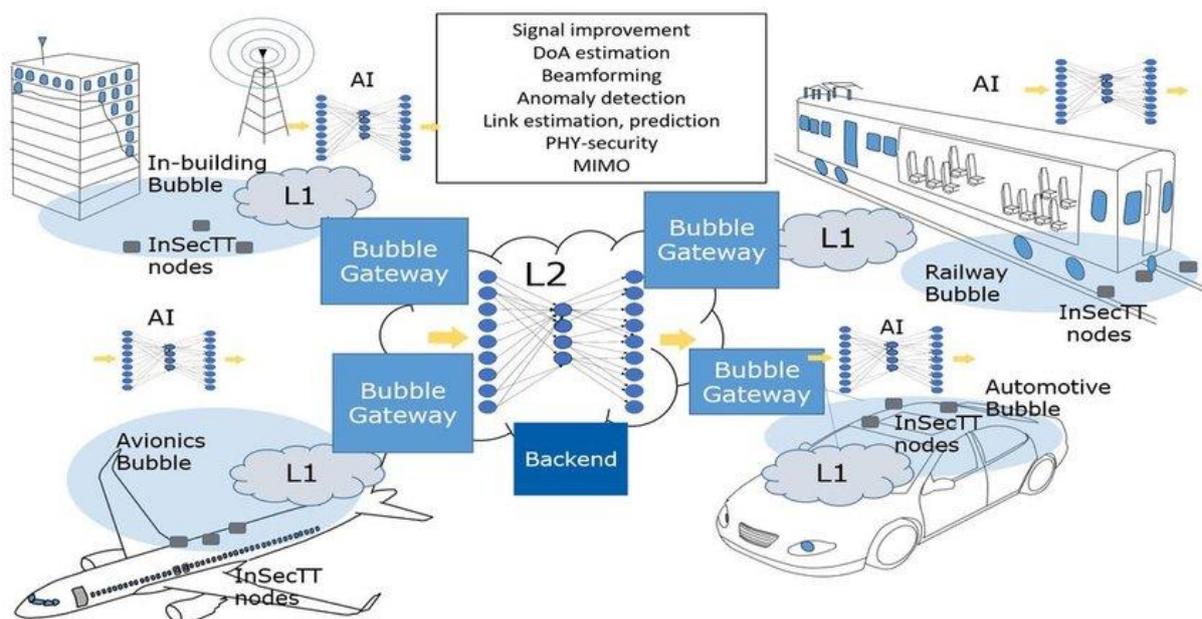
Sep 28, 2021

The InSecTT project addresses the convergence of artificial intelligence (AI), machine learning (ML), edge computing, and the Internet of Things (IoT). One of the potential benefits of this synergy is the boost in performance of the communication process between network entities. InSecTT proposes different types and families of AI algorithms that aim to improve the performance of communication links in different critical industrial use cases.

ISEP is the leader of the building block related to artificial intelligence and machine learning algorithms for improved communications. The algorithms developed in this building block obtain their information from different layers of the communication stack of different network entities, and proceed to predict, detect, estimate or optimize models or signal parameters that can be used to improve performance metrics in the same or in other layers.

Some of the algorithms that will be developed in this building block include AI and ML algorithms for improved multiple antenna or MIMO (multiple input multiple output) signal transmission/reception, including channel estimation, precoding, equalization and compensation. Massive MIMO is particularly attractive for ultra-reliable and ultra-low latency 5G/6G communications. Therefore, the optimization of this technology is expected to have a direct impact on critical industrial use cases such as autonomous vehicular platoons, real-time traffic management, wireless avionics intra-communications and fly-by-wireless drone and aircraft traffic control.

Interference is also expected to increase its presence and its effects on in future networks. Therefore, InSecTT looks into the use of accurate AI and ML algorithms that can detect accurately sources of interference or properties of the jamming signals such as direction of arrival to help reduce their effects. Important efforts will be devoted in the use of semi blind or unsupervised ML to predict, estimate or track channel variations and thus improve connectivity in multiple interface gateways, routing in heterogenous networks, security in spatially correlated networks, or reduce the amount of training sequences in large network deployments. Finally, another important set of algorithms to be developed collect data from different streams of information in the network and detect anomalies and or predict failures and thus enable the use of security measures that improve the reliability of different use cases.



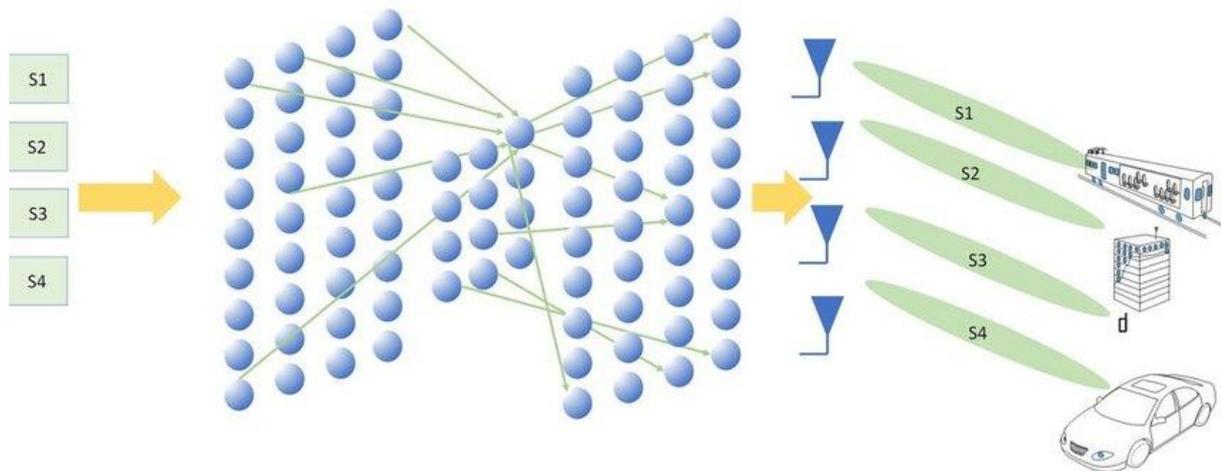
## Artificial Intelligence for wireless communications

Sep 27, 2021

CISTER/ISEP is involved in the development of artificial intelligence (AI) and machine learning (ML) algorithms for the specific improvement of wireless communications, particularly in the case of multiple-input multiple-output systems also known as MIMO. MIMO systems are the basis of future communication technologies such as 5G. Their advantage lies on the fact that capacity scales with the number of antennas at the expense of moderate bandwidth costs. This allows us not only to increase capacity, but also improve spectral efficiency.

AI/ML is expected to boost the performance of MIMO systems by reducing the few issues found in their practical implementation, for example training sequence design, outdated channel state information, non-linearities, noise amplification and residual errors.

ISEP targets the exploitation of semi blind signal processing or unsupervised learning algorithms to reduce the amount of training sequences in the network, and so allow the use of massive number of antennas or massive MIMO with higher spectral efficiency. ISEP also targets AI-based channel estimation and channel prediction algorithms to improve the accuracy of precoding and decoding MIMO technologies that currently suffer from outdated CSI and non-linear effects.

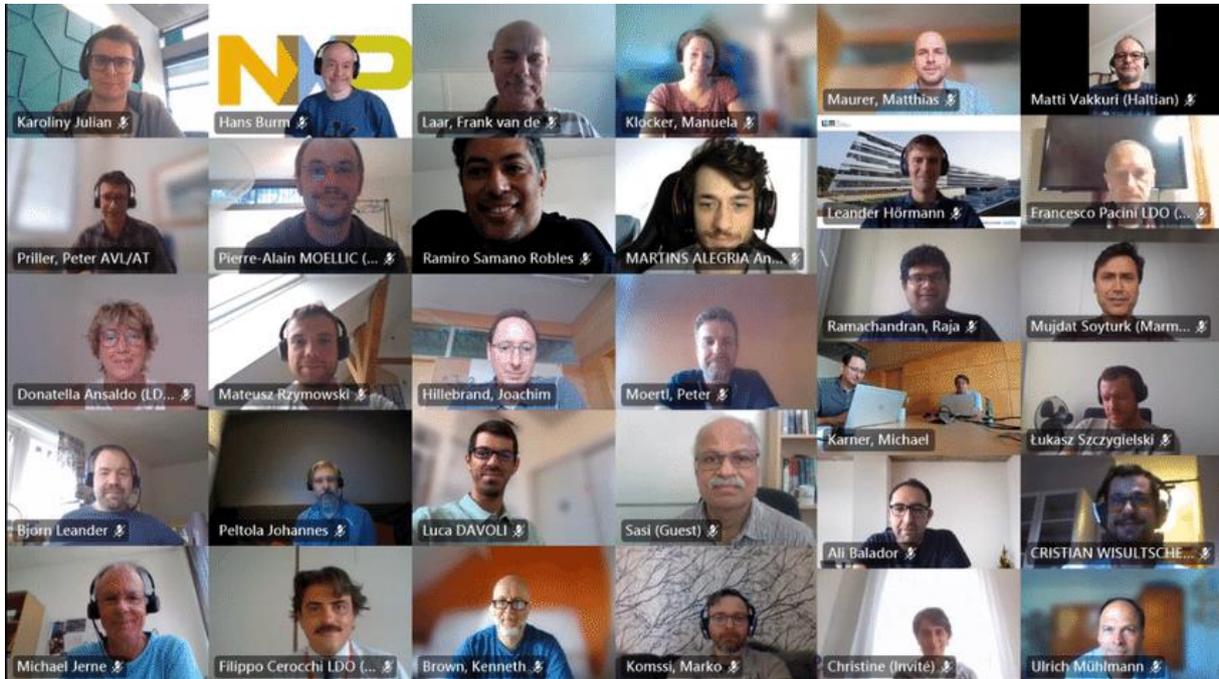




## First InSecTT review meeting

Sep 15, 2021

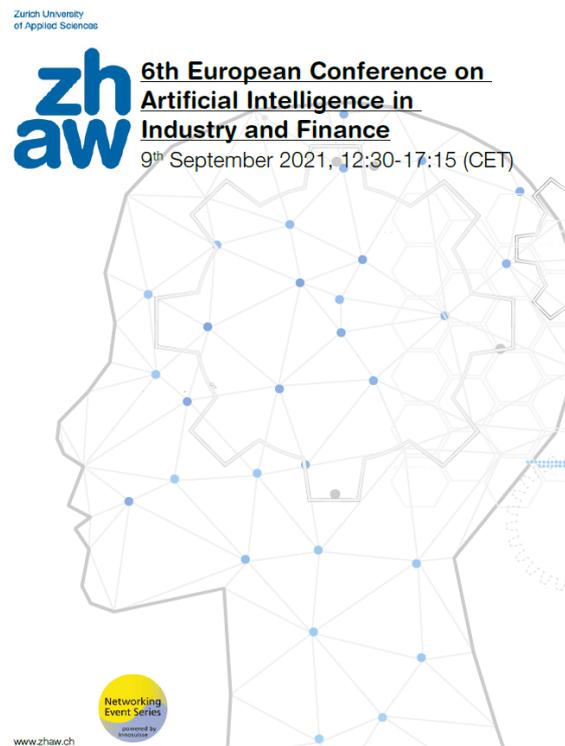
The next important challenge in the framework of InSecTT project is just taking place: The first review meeting has just started. Therefore, the consortium has prepared slides, videos and demonstrators to report on the projects' highlights, achievements and results and the progress made. We are looking forward to the feedback from our PO and the reviewers. In particular, we thank all partners for the good preparation of the meeting and all the presenters at the Review Meeting for their valuable contributions and excellent performance.



# Bringing Internet of Things and Artificial Intelligence Together – But Is It Trustworthy?

Sep 8, 2021

On 9th of September, InSecTT Coordinator Michael Karner (Virtual Vehicle) gave an invited talk on "**Bringing Internet of Things and Artificial Intelligence Together – But Is It Trustworthy?**" at the **6th European Conference on Artificial Intelligence in Industry and Finance**.



# AI, machine learning and image processing to bring explainable AI and trustworthy Internet of Things

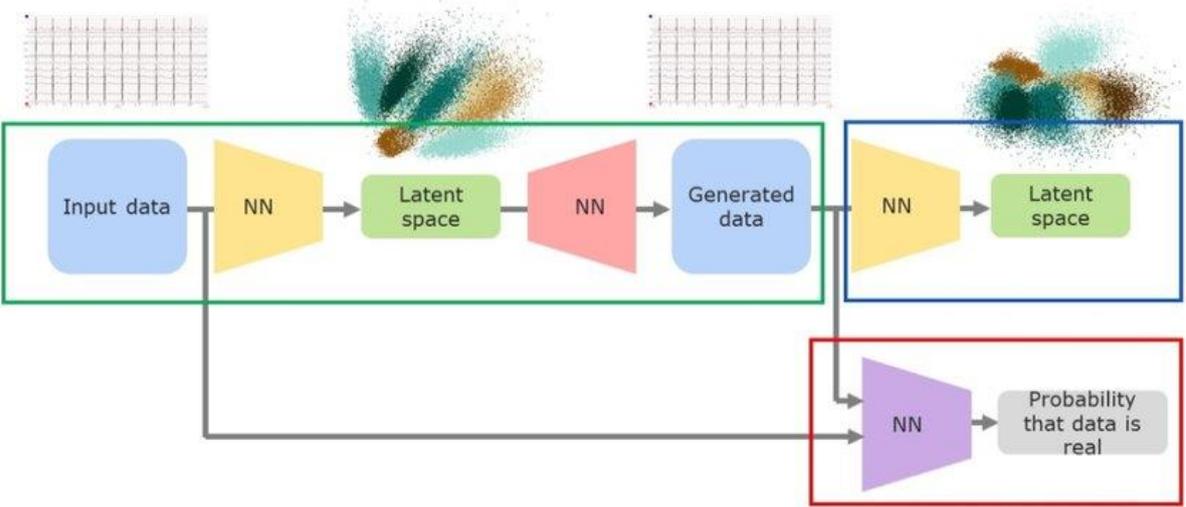
Sep 7, 2021

JSI is happy to participate in the InSecTT project where we make available our expertise in AI, machine learning and image processing to bring explainable AI and trustworthy Internet of Things together.

JSI focuses on two contributions. The first one is localization awareness in Mass Casualty Incidents where we contribute to the advanced system reporting the location of casualties and their injury status to the server so the arriving rescue teams have this information in advance.

The second one is a smart hospital solution where we contribute to patient risk assessment based on measured biomedical signals processed with deep learning technology..

## Machine learning architecture



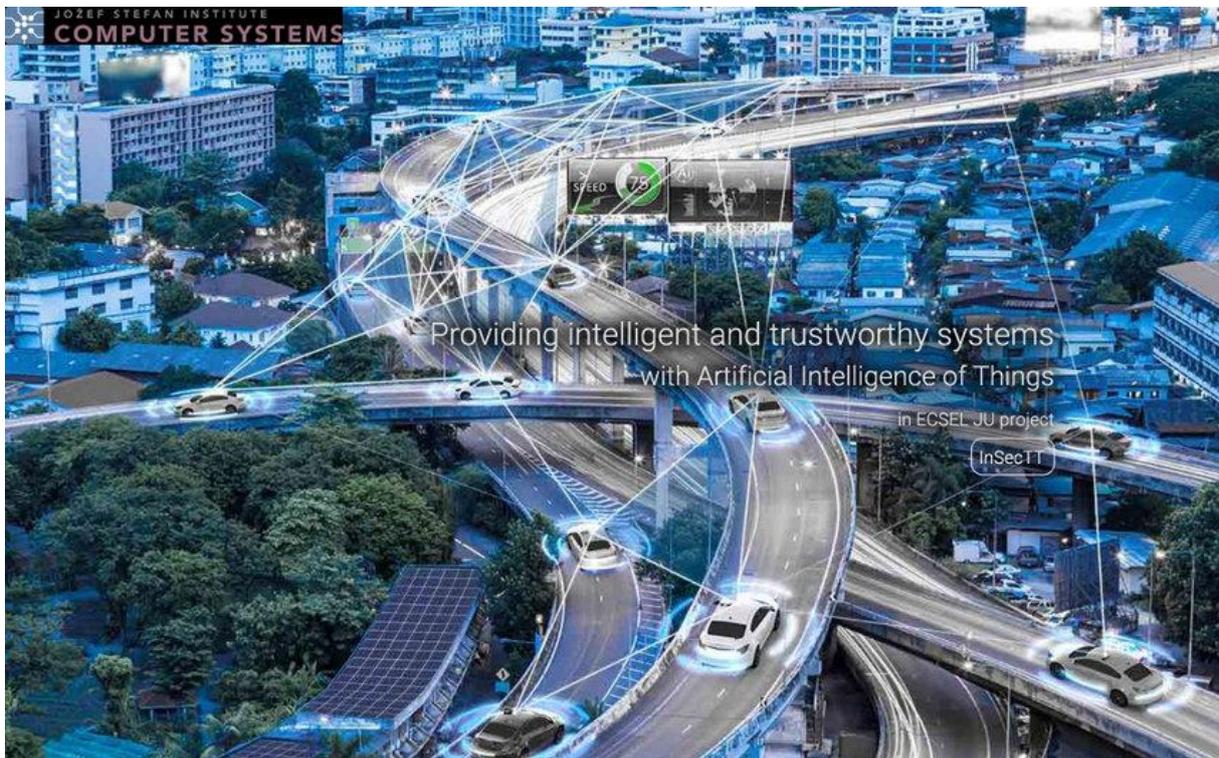
# Jožef Stefan Institute is a partner in InSecTT

Aug 30, 2021

The Computer Systems Department of Jožef Stefan Institute (JSI), the biggest Slovenian public research institution with the staff over 1000 specialized in natural sciences, life sciences and engineering, is proud to be a research partner of the InSecTT project.

We actively participate to the project goal to bring together explainable Artificial Intelligence and Internet of Things resulting in intelligent, secure and trustworthy systems for applications in variety of fields. Our focus is in the smart and adaptive connected solutions across health continuum where we bring in our expertise in AI, machine learning and image processing. Together with project partners, we strive to ensure that our solutions will be used in future healthcare applications.

Find out more on health domain within the InSecTT at <https://www.insectt.eu/domains/health/>



# The special challenges in the consumer IoT environment

Aug 3,2021

The main research focus of F-Secure within the InSecTT project concerns AI-based anomaly detection for IoT network traffic in consumer home environments. This security research needs to consider the special challenges in the consumer IoT environment.

First, a typical consumer is not a security expert who can carry out a response to a cyber-attack. We therefore we aim to develop a model whose behavior can be explained and whose output can be effectively communicated to consumer users of the security home router.

Second, security operations must be cost-efficient and take into account the restrictions of consumer WiFi routers, for example the limited CPU capacity and memory.

And finally, as network traffic is increasingly changing to HTTPS and other encrypted connections, we therefore need to carry out any such security operations also for encrypted traffic.



## QUIC protocol

Jul 19, 2021

Transport layer protocol power relations have undergone some changes during the last years. The recently standardized QUIC protocol was developed to address some latency and scaling issues in traditional TCP, as well as to better meet the needs of mobile clients and online streaming. QUIC has also been drafted as the transport protocol HTTP/3, which means its share in network traffic will only grow in the upcoming years. Unlike HTTPS implemented over TCP+TLS, QUIC exchanges TLS keys right at the initial handshake, which introduces a challenge to any connection monitoring network equipment.

Extracting the Server Name Indication (SNI) information from QUIC connections for anomaly and threat detection is one of the topics F-Secure will be focusing on in the InSecTT project.

```

#define Q_HDR_RESERVED 0x0c // Protected
#define Q_HDR_PN_LEN 0x03 // Protected
byte version[4];
vlb_t dst_conn_id;
vlb_t src_conn_id;
vlint_t token;
vlint_t length;
vlb_t pn; // Packet number, protected. Length determined by Q_HDR_PN_LEN once unmasked.
uint8_t payload_offset = 0;
byte *payload;
};

static quic_pkt *parse_quic_header(const byte *ptr) {
    struct quic_pkt *hdr = (quic_pkt *)malloc(sizeof(quic_pkt));

    hdr->flags = *ptr++;
    memcpy(hdr->version, ptr, 4);
    ptr += 4;

    // Destination connection ID
    hdr->dst_conn_id.len = *ptr++;
    hdr->dst_conn_id.val = (byte *)ptr;
    ptr += hdr->dst_conn_id.len;

    // Source connection ID
    hdr->src_conn_id.len = *ptr++;
    hdr->src_conn_id.val = (byte *)ptr;
    ptr += hdr->src_conn_id.len;
}

```

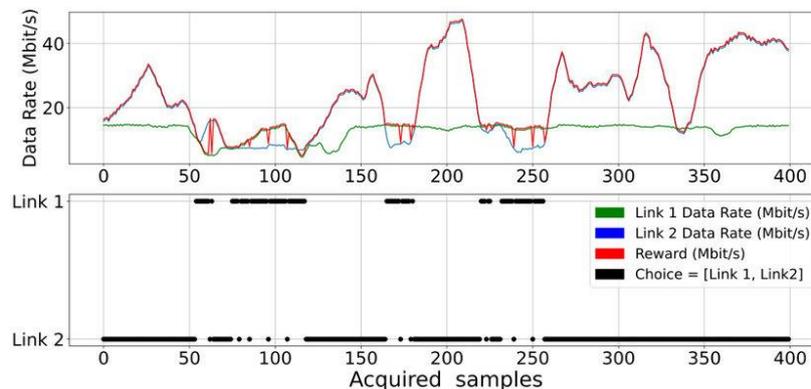


## Network selection with the help of AI

Jul 1, 2021

When you have multiple network options, how do you know which is the best network to use for communication while being on the move? And what happens when your link quality drops? Artificial Intelligence can help with that.

The Irish InSecTT partner Munster Technological University (MTU) develops AI methods to dynamically monitor and compare the available links to connect to the best network. The AI methods will predict when it is time to change to a better link, and change it automatically to prevent your connection from being lost.





## AI-supported link quality prediction

Jun 28, 2021

When travelling at high speeds, such as in a train, the quality of mobile connections changes constantly. However, onboard systems on trains need reliable, predictable connections, for diagnostic data about the train systems as well as for services such as passenger WiFi.

In InSecTT, researchers from Irish partner Munster Technological University (MTU) work on methods to estimate and predict connection quality. Real life mobile network data collected on journeys in Ireland are used as a basis to develop Artificial Intelligence solutions provide insight into the current and near-future quality that can be expected.

