Advances
The main Stream contributions are:
• A cloud computing platform, StreamCloud, for providing real-time services over massive data flows, characterized by high expressivity (the same expressiveness as state of the art data streaming engines) and scalability (ability to scale to 100s of nodes).
• A data mining platform, StreamMine, able to perform online and real-time data analysis in combination with the data streaming platform.
• A communication infrastructure with low cost and storage infrastructure characterized by being able to store streaming data at network rates.

Positioning in global context
Stream processing and complex event processing are emerging computing paradigms, which are gaining more and more attention, both from the academia and from the industry. STREAM outperforms currently available products by a novel parallelization approach. The STREAM platform is able to parallelize the processing of information flows in large clusters of 100s sites. Current approaches fail to scale for massive information flows. STREAM boosts the scalability of current approaches in 2 orders of magnitude. A high performance communication layer enables an efficient interaction among sites with low communication overhead. The storage layer is able to persist data streams at network rates enabling efficient and cost-effective fault-tolerance.

Target users / sectors in business and society
Potential users of the STREAM platform are software vendors and business sectors who need to process massive amounts of data in real-time fashion, this includes the Internet of Things (e.g. the Smart grid), ICT security, monitoring of large grid and cloud infrastructures, telecommunication...
infrastructure, processing of the output of large sensor networks (e.g. instrumented roads and highways), social networks, etc.

**Overall Benefits for business and society**

A computing platform like STREAM is the technology enabler for a whole plethora of real-time applications which are currently impossible, such as credit card fraud detection. Credit card fraud is a growing concern of global proportions. Resourceful criminals are finding creative ways to capture private credit card holder account and identification information, and are using this information for fraudulent acquisitions of everything from personal care items to cars to home loans. Because of the universal reach of the Internet, criminals are easily able to perpetrate their crimes from anywhere in the world. The costs of credit card fraud reach nearly €1.8 billion annually in the EU-27. Internet fraud alone accounts for nearly 3% of Internet sales, or 30 times higher than credit card fraud rates in the “physical world.” While consumers are generally held harmless for credit card fraud, the payment industry and merchants absorb the losses from fraudulent purchases, and its participants continually search for ways to detect and prevent them. The STREAM project has demonstrated that real-time fraud detection is feasible using the STREAM platform.

**BUSINESS SCENARIOS**

The STREAM platform has been validated in three business scenarios, namely

- **Cellular Telephony Anti-Fraud Pilot** – According to FCC (Federal Communications Commission), cell phone fraud is defined as the unauthorized use, tampering, or modification of a particular cell phone device or service. Malicious individuals combine complex software and hardware devices to illegally monitor data transmissions from the cell phones of authorized subscribers. With this stolen data, they are able to clone the compromised phone with one that has been reprogrammed to retransmit the electronic serial number (ESN) and phone number of another authorized cell phone user. As the service provider cannot determine a difference, the fraud goes undetected. The Cellular Telephony Anti-Fraud pilot application detects in real time the cloning fraud and builds and updates customer profiles which comprise customer behavior and which, besides facilitating fraud detection, will give a better understanding of its customers to the Telefónica Company.

- **Credit Card Payment Management Pilot** – As already mentioned, credit card fraud is a growing concern of global proportions. The STREAM platform has proven to be a powerful tool for credit card detection. The pilot application uses all available data – account, payment and non-monetary – in the fraud decision making process.

- **Quality of Service monitoring pilot** – Dependable QoS monitoring has become a key requirement in a variety of business applications (virtually all applications which involve multiple parties). The QoS monitoring pilot application detects in real-time violations of the Service Level Agreements which have been agreed between the provider and its customers, and ii) provides unforgeable evidence of such violations.

**Achievements**

- **StreamCloud**: largely scalable parallel-distributed data streaming engine (IPR protected by a filed international patent) featuring elasticity, fault-tolerance, visual development environment, parallel compiler, cloud deployer, real-time graphical performance monitor.

- **StreamMine**: scalable customizable layer for mining data streams.

- **High performance storage tier and low-overhead communication tier.**