

## Tutorial Proposal

1. Email:

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2. Title:

Reliable & Available Wireless Mesh Networking

3. Abstract:

The Internet of Things (IoT) has become ubiquitous due to its flexibility, ease-of-use, and reduced cost. As a consequence, the industry is adopting these systems in its transformation into Industry 4.0. However, the strict Quality of Service (QoS) requirements of the industry are not met with the default best-effort provisions of the IoT. Most industrial applications require strict guarantees in terms of end-to-end network reliability and latency. For instance, consecutive packet losses can lead to communication disruptions in supply chain systems. Therefore, adaptations are being made to fulfil these requirements with the IEEE Std 802.15.4-2015 Time slotted Channel Hopping (TSCH) link-layer standard and the IPv6 Routing Protocol for Low-Power and Lossy Networks (RPL) standard at the Internet Engineering Task Force (IETF). However, even by employing such industrial protocols, it is still difficult to achieve the expected QoS levels. Considering that RPL constructs and maintains a single-path from a source to a destination if there are potential issues on this path (e.g., queue overflow, variable wireless link quality) packets may suffer unexpected delays and even drops. If we consider a multi-path implementation where each node can replicate a packet into several paths, the transmission reliability improves since each packet copy is used to forward the packet information. However, uncontrolled replication can lead to network flooding, resulting in excessive power consumption.

In this tutorial, I will present several routing algorithms and protocols that improves network reliability and availability. I will start first with the Packet Automatic Repeat reQuest, Replication and Elimination, and Overhearing (PAREO) functions. Then, I will continue with two N-Disjoint algorithms and three Common Ancestor (CA) algorithms that select the most suitable upward relay nodes. Finally, I will conclude with the latest and the most efficient On-Demand Selection (ODeSe), multi-path routing algorithm. Note that the PAREO functions and the CA algorithms are work-in-progress drafts at the IETF standardisation organisation.

4. Objectives:

To present state-of-the-art algorithms and protocols that enables Reliable and Available Wireless communication and networking from the academic and IETF point of view.

5. Topics covered:

- Reliable and Available Wireless (RAW)
- Deterministic Networking
- Routing algorithms and protocols
- Low-power Wireless Mesh Networks
- Standardization

6. Projected Audience/Background:

Basic knowledge in computer networks.

## 7. Tutorial content:

The envision program of the tutorial is the following:

- Context: Deterministic Network / RAW
- Use cases
- Problem statement
- PAREO Functions
- State-of-the-art Algorithms and Protocols
- Performance Evaluation

## 8. Presenter Experience:

The presenter have already gave tutorials in the following events:

- [4 hours - 30 attendees] Georgios Z. Papadopoulos, Nicolas Montavont, Title: "Industrial Internet of Things: from Best Effort to Quality of Service", Venue: IEEE 5th WF-IoT'19, April 2019, Limerick, Ireland.
- [2 hours - 30 attendees] Georgios Z. Papadopoulos, Nicolas Montavont, Title: "Toward Deterministic Traffic in 6TiSCH Networks", Venue: GIIIS'18, October 2018, Thessaloniki, Greece.
- [3 hours - 20 attendees] Fabrice Theoleyre, Georgios Z. Papadopoulos, Title: "Industrial IoT: From best-effort to strict guarantees", Venue: Summer School on Emerging Technologies for 5G and Internet of Things, organized by Hellenic Open University, 9 July 2017, Thessaloniki, Greece.