

Research on Auto-routing technology over Smart Substation Network

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Introduction

Based on the characteristic of IEC 61850 Substation Configuration Description (SCD) file, a novel technology of auto-routing is brought out, which can automatically build a GOOSE/SV (Generic Object-Oriented Substation Event/Sampled Value) path to give a flexible way to configure and manage a substation network. GOOSE/SV path is kind of a novel term developed to define a GOOSE/SV multicast distribution tree created in substation network to implement GOOSE/SV association by means of IED-learning and network topology discovery. It offers a plug-and-play capability for IEDs that need to access the substation network to subscribe/publish information.

Principle of auto-routing

Goal of auto-routing is to build GOOSE/SV paths automatically according to substation network topology and SCD file, five steps are needed, including collection of IED-bridge connectivity information, collection of network topology information, plot of GOOSE/SV path, installation of GOOSE/SV paths, and verification of GOOSE/SV path. Illustration of auto-routing is showing in Figure 1.

Cooperation with other technologies

Rapid Spanning Tree Protocol (RSTP), HSR (High-availability Seamless Ring), and auto-routing all provide network redundancy. RSTP, HSR works in MAC layer, while auto-routing operates between MAC layer and network layer, so they can cooperate together without conflict, see Figure 2 and Figure 3.

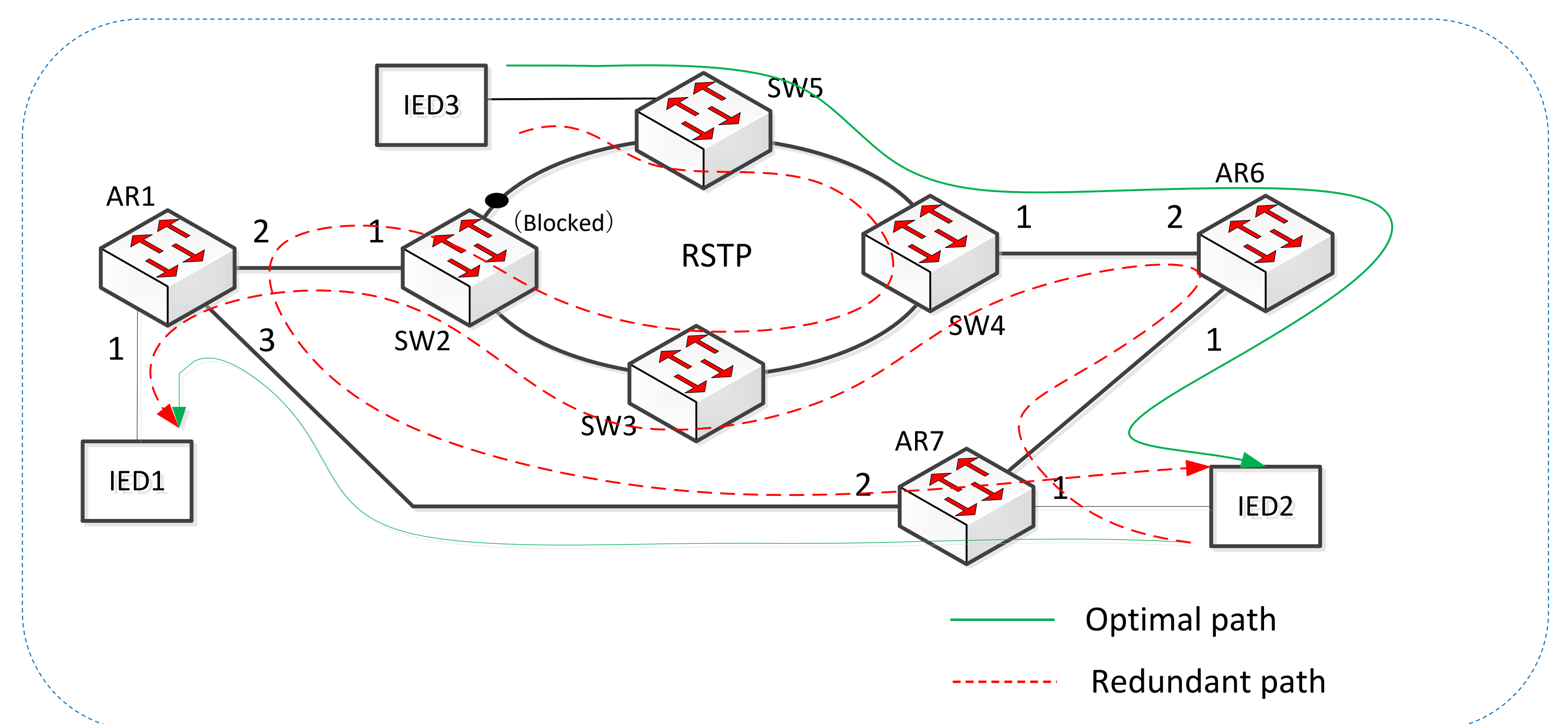


Figure 2 – Auto-routing cooperation with RSTP

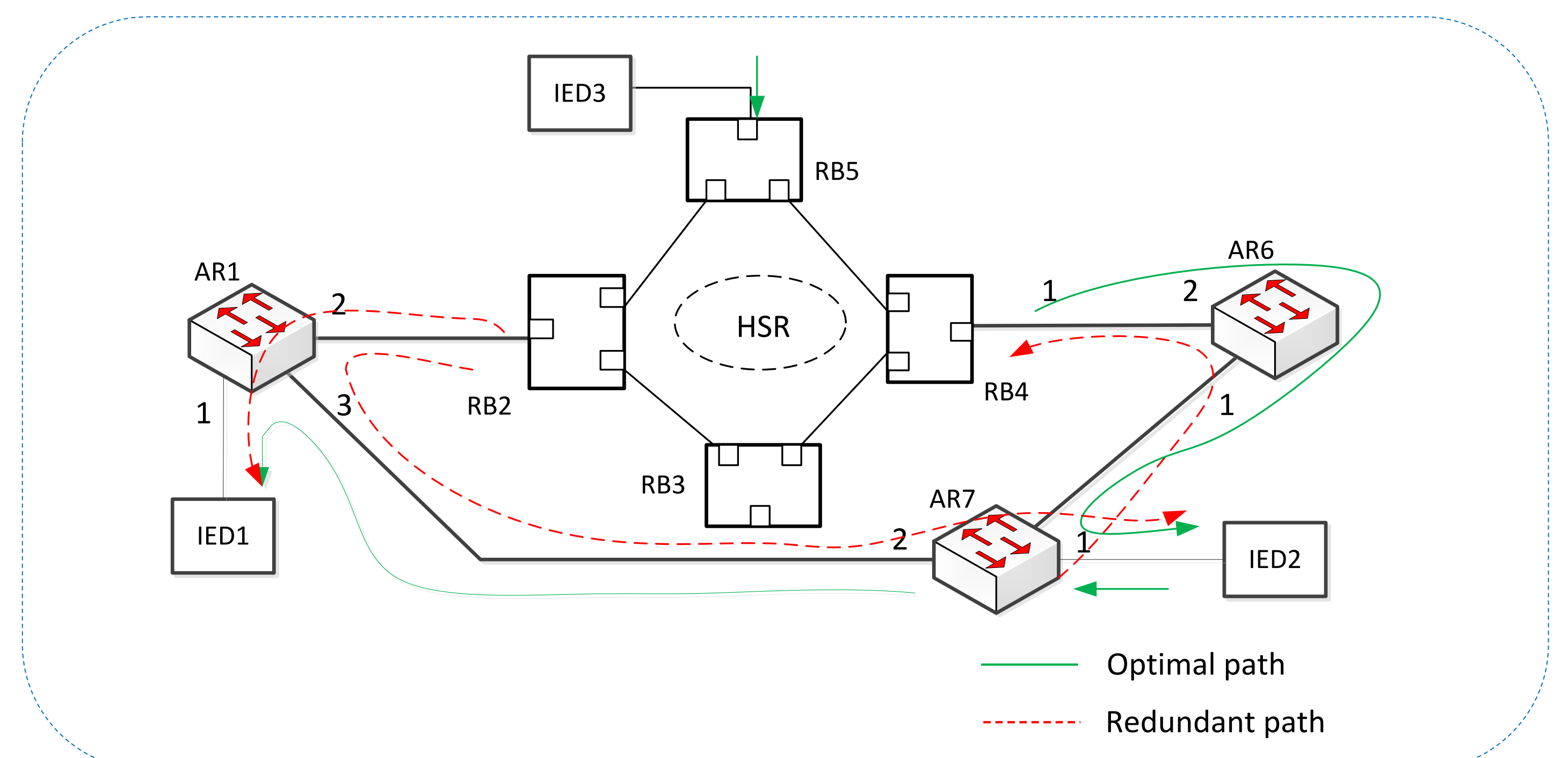


Figure 3 –Auto-routing cooperation with HSR

Conclusion

Auto-routing is a system-level functionality of substation network performing, and can co-existing with HSR and RSTP within one substation network. With no predesigning VLAN, no necessary IED-relate-port cable/fibre connecting checking step, advantages of plug-and-play and online-verification make auto-routing technology perfectly for substation network construction, and it could support easy supervision and visualization to speed up the applications of IEC61850.

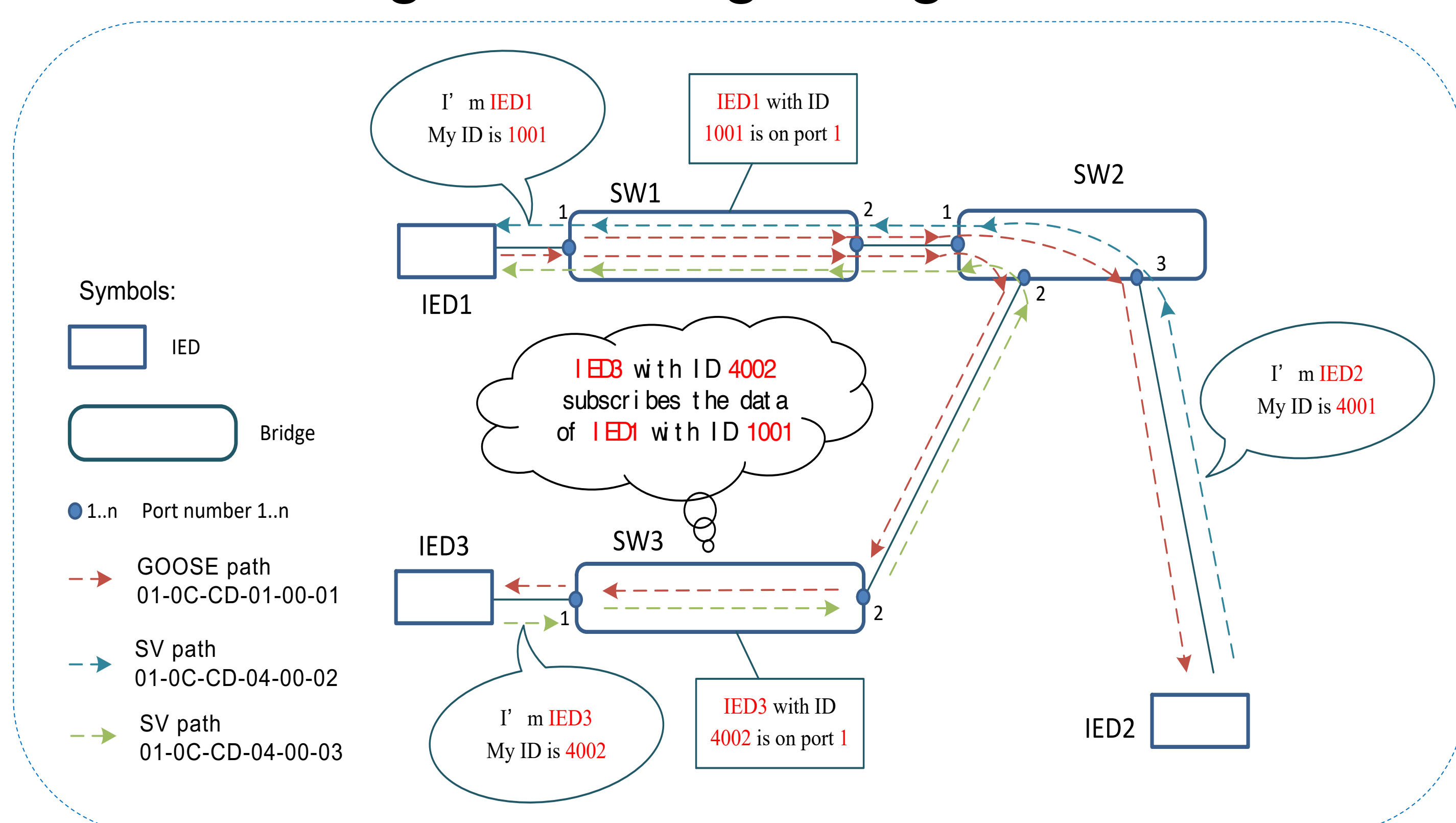


Figure 1 – Demonstration of auto-routing

Key point of auto-routing is to establish a mechanism for substation network to percept, identify and forward different GOOSE/SV messages by demand of SCD.