

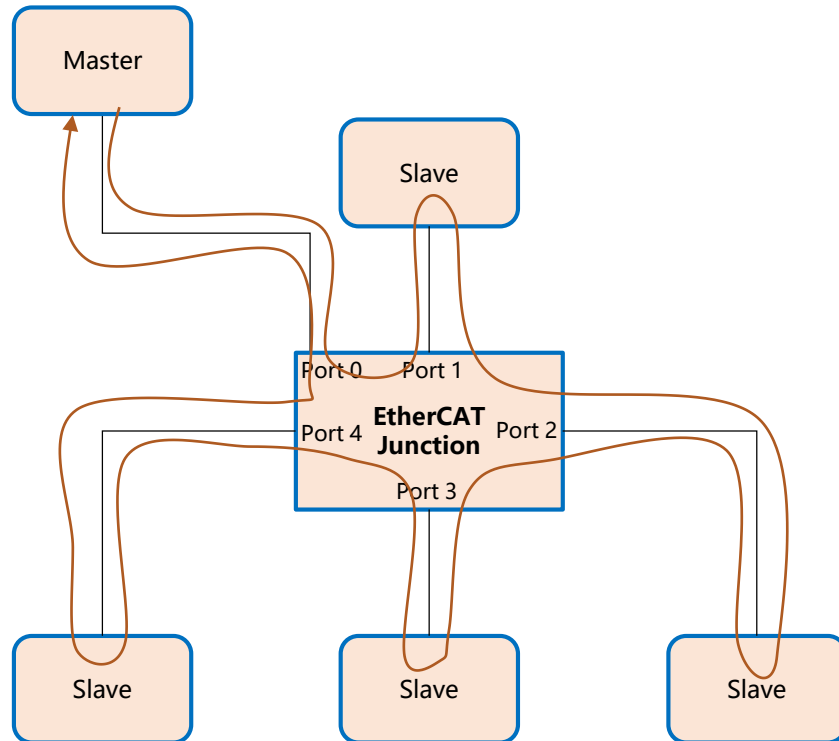
# Elastic Ethernet based on Converged Switch

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# Background

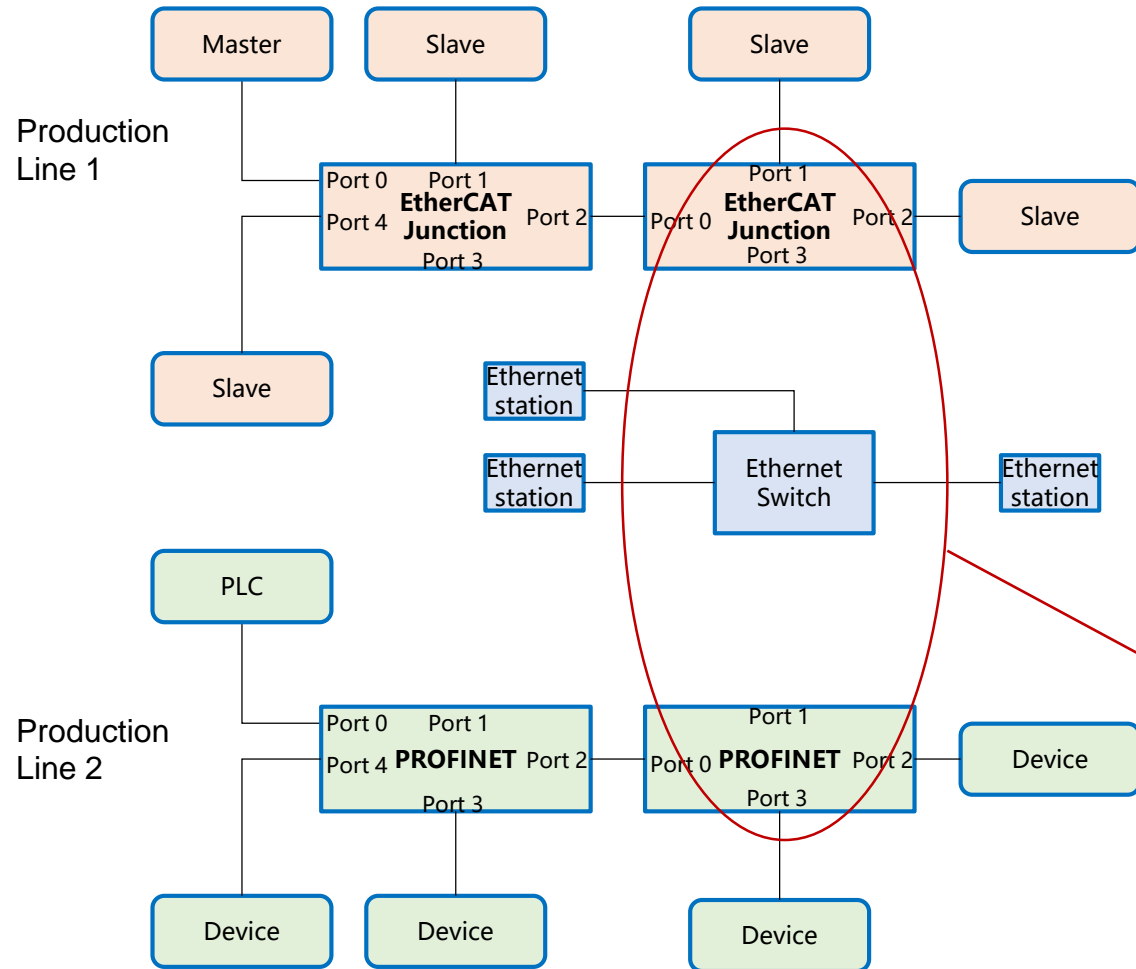
- Regarding Elastic Ethernet, several presentations were discussed, and leading the specific issues to be focused on.
  - ❑ 2021-05-16 [Industrial Network based on Convergent & Elastic Ethernet](#)
    - ✓ Weak determinism
    - ✓ Centralized management
    - ✓ Extreme low latency / jitter
  - ❑ 2021-05-06 [Convergent & Elastic Ethernet Networking for Industry](#)
    - ✓ Convergent industrial network based on Ethernet
  - ❑ 2021-04-07 [Elastic Ethernet Networking for Industry](#)
    - ✓ Elastic Ethernet framework
  - ❑ 2021-11-18 [Low Latency Discussion for Ethernet Networking](#)
    - ✓ Extreme low latency / jitter analysis
- This presentation discusses one of the issues, analyzes the pros & cons, and explores a potential solution.

# An Example of EtherCAT Network with Star Topology



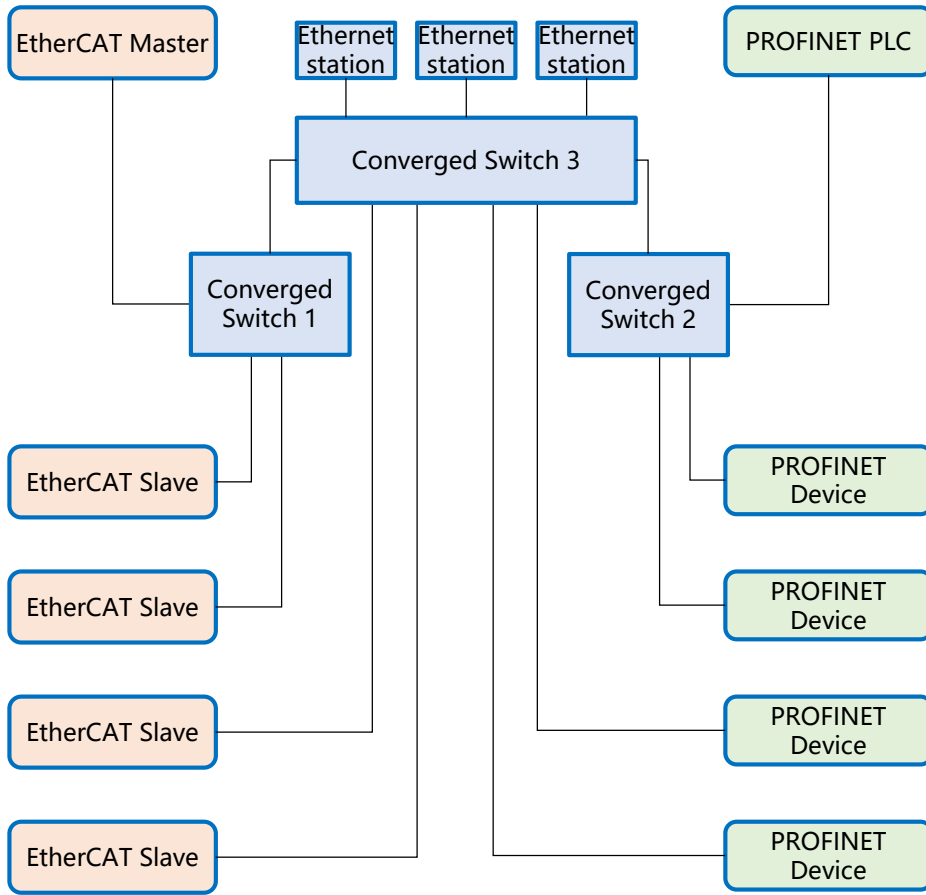
- The basic principle is that internally the EtherCAT frames continue to be transported in a logical ring:
  - ❑ the EtherCAT master sends the frame on the port 0 of the EtherCAT junction
  - ❑ this frame passes each port & each slave once,
  - ❑ and is returned to the master through port 4 & port 0.
- But the EtherCAT junction **cannot be used as an Ethernet bridge.**
- *Is it possible to forward EtherCAT frames & standard Ethernet frames simultaneously in a converged forwarding device?*

# More Complicated Scenarios



- Different production line use different industrial networks via different industrial frame forwarding devices.
  - Because the devices are discrete, the whole systems are connected as daisy chain topology, and each switch nodes connect the devices as star topology.
  - Nearby some switch nodes, there are some Ethernet switches and stations and devices of other industrial network.
- Is it possible to forward EtherCAT frames, PROFINET frames & standard Ethernet frames simultaneously in a converged forwarding device?*

# Converged Switch



- The converged switch forwards standard Ethernet and connects all EtherCAT devices and PROFINET devices.
- The converged switch could forward the EtherCAT frames and PROFINET frames simultaneously.
- With multiple new forwarding rules, the converged switch could support a few kinds different forwarding mode of different Ethernet-based industrial networks.
- Moreover, the Converged Switch should assure the QoS for each industrial network.

# How to assure the QoS based on Converged Switch

## ➤ Centralized Management

- ❑ Collect & manage attributes and QoS request of different kinds of traffic
- ❑ Unified to manage bandwidth resource & time slots
- ❑ Schedule different traffic of different industrial production line / cell
- ❑ Distribute the result rules of scheduling to different kinds of devices

## ➤ Improve the forwarding delay

- ❑ Cut-through forwarding
- ❑ Payload optimization according to frame size

## ➤ Questions to be studied

- ❑ How to be agile to centralized management as the network scales out or is updated?

# The Pros & the Cons of Converged Switch

Category	Pros	Cons	Potential Solution
Forwarding	<ul style="list-style-type: none"><li>• one category of switch could afford multiple scenarios</li></ul>	<ul style="list-style-type: none"><li>• Unease to support some forwarding mode different from standard Ethernet</li><li>• risk of QoS, how to assure the low latency / jitter, to avoid the affecting between different kinds of traffic</li></ul>	<ul style="list-style-type: none"><li>• To support different forwarding mode based on converged switch with new designed forwarding table</li><li>• To improve the mechanism of forwarding process for different kinds of traffic</li></ul>
Management	<ul style="list-style-type: none"><li>• centralized management based on converged switch leads to the overall effectiveness (e.g. proper traffic routing)</li></ul>	<ul style="list-style-type: none"><li>• to schedule each traffic of different kind, may lead to more complication of management, how to improve the management process and corresponding tool</li></ul>	<ul style="list-style-type: none"><li>• To provide unified tool to implement the management functionality</li></ul>
Extension	<ul style="list-style-type: none"><li>• to plan from the whole viewpoint, and to be good to get the optimal extension solution</li></ul>	<ul style="list-style-type: none"><li>• to avoid affecting between different kinds traffics of existing &amp; extended</li></ul>	<ul style="list-style-type: none"><li>• To provide unified tool to implement the extension &amp; management functionality</li></ul>

# Next Steps

- To explore converged switch solutions to assure the QoS of existing industrial services and standard Ethernet services
  - ❑ There are 2 basic request should be satisfied: topology & forwarding. As it's not possible to change the devices currently, we have to support the different topology & forwarding mode of existing industrial network.
  - ❑ The third & important request is to assure the QoS for the existing devices.
  - ❑ Finally, how to adjustment network effectively, as the network changing or extension according to the service / marketing request.
- To initiate a study item for this converged switch solution as following potential aspects.
  - ❑ Elastic topology / forwarding for different industrial scenarios.
  - ❑ Assure QoS for all devices connected by the converged switch.
  - ❑ Centralized & effective management / scheduling.



Thank you.