



# **Regional Fault Tolerant Recovery Mechanism for Multilayer**

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**Background Overview**

**Multilayer Networks Architecture and  
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**Conclusion**

- ✓ Fiber communication network is the main means of transmission of modern communication network, the restoration mechanism of fiber communication becomes the focus of network operators' attention.
- ✓ We introduce the SDN framework and an improved RSA algorithm into fiber communication networks
- ✓ We propose a new restoration mechanism which has a better performance.

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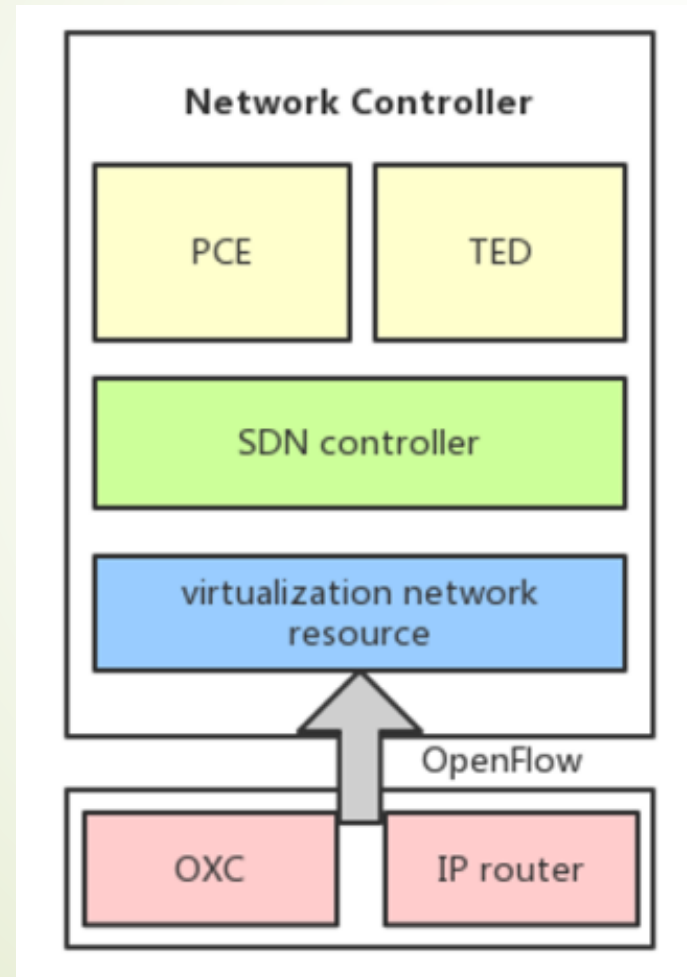
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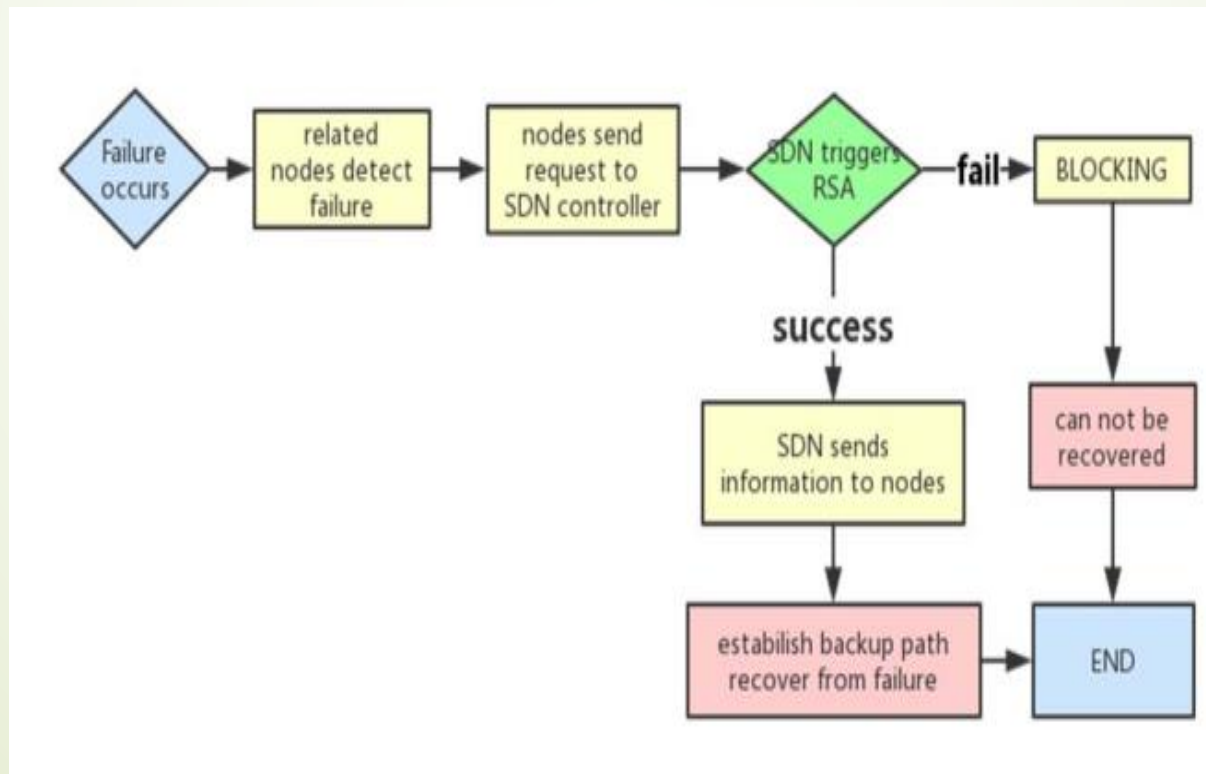
- **FIBER COMMUNICATION NETWORK ARCHITECTURE**



## ● RESTORATION MECHANISM

We decompose the restoration process into two equally important parts to discuss : information transfer and backup path calculation.

### ◆ Information transfer



## ● RESTORATION MECHANISM

### ◆ Backup path calculation

We improve the traditional RSA algorithm proposed in related reference[5]. On this basis, we introduce path survivability in face of regional failure.

- First, we define the distance between two links as the following formula.

$$d_{l_1, l_2} = d_{m_1, m_2}$$

- Second, we give the definition of the distance between a path and the failed link  $\alpha$ .

$$d_{P_l, \alpha} = \frac{\sum_{i=1}^l d_{\alpha, l_i}}{l}$$

- Then, we define the probability that path  $R_l$  is affected by the failed link  $\alpha$ .

$$fp_{R_l} = e^{-\beta(d_{P_l, \alpha})^2}$$

- Finally, we use this equation to evaluate the probability for path  $P_l$  to survive from failed link  $\alpha$ , which represents the survivability of path  $P_l$ .

$$wp_{P_l} = 1 - fp_{P_l} = 1 - e^{-\beta(d_{P_l, \alpha})^2}$$



- **RESTORATION MECHANISM**

## ◆ Backup path calculation

- The biggest promotion of proposed RSA algorithm is that it takes influence of regional failure into account.

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### *Algorithm*    Regional fault-tolerant improved RSA

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**Input:** required spectrum capacity  $\omega, \beta$

**Output:** Routing path PR, Spectrum allocation SR

PCE gets virtual network topology from TED.

**FOR** available path  $L_i$  in topology  $i = 1$  to  $n$  do

**CALCULATE** the PCD  $D_R$  (proposed in [20]) of path  $L_i$

**IF**  $D_R \leq \delta$

            stored  $L_i$  IN set  $S$ ;

$i=i+1$ ;

**IF**  $S$  is empty

**END BLOCKING**;

**ELSE**

**FOR**  $L_j \in S$   $j=1$  to  $SUM(S)$

**CALCULATE**  $wp_{L_j}$  for  $L_j$ ;

**SORT**  $S$  by  $wp_L$ ;

**OUTPUT**  $k$ -biggest value in  $S$  as PR,SR;

**END**

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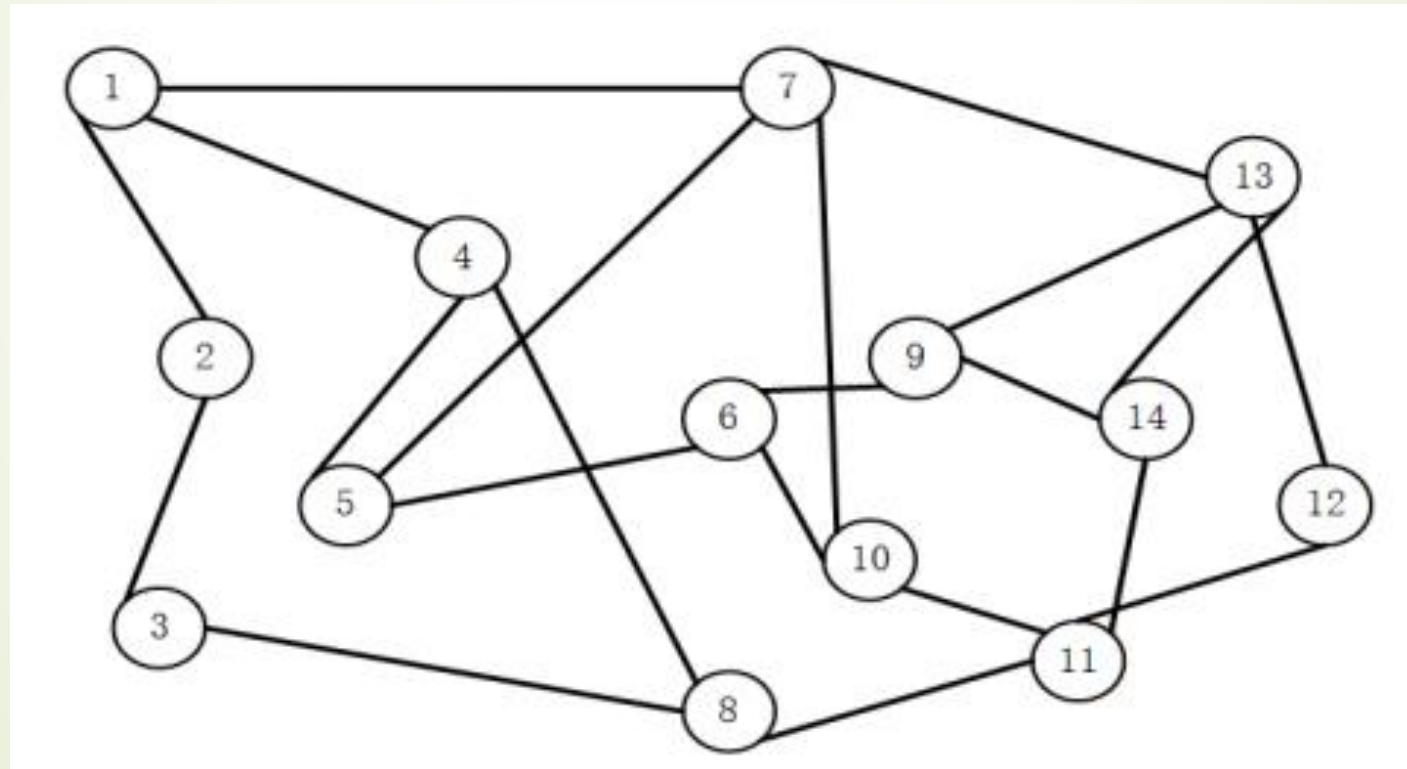
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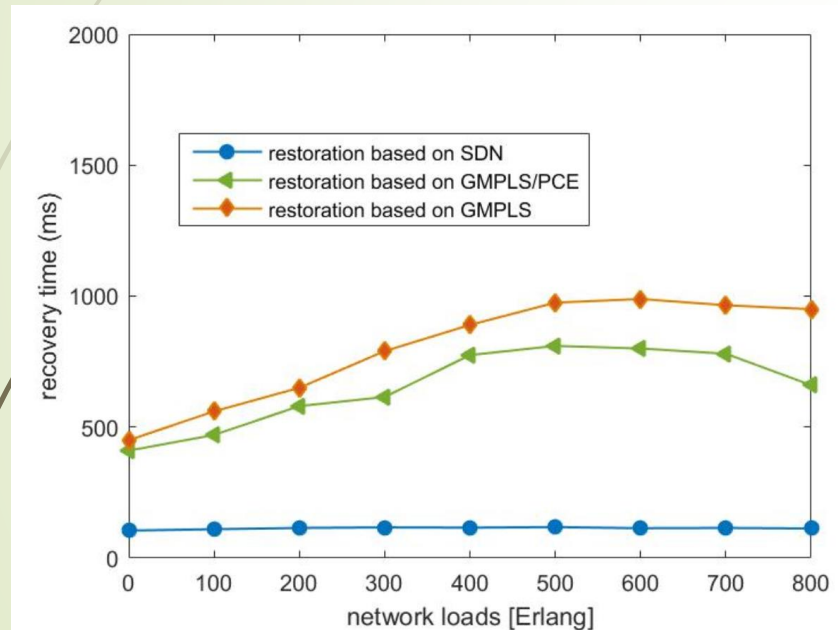
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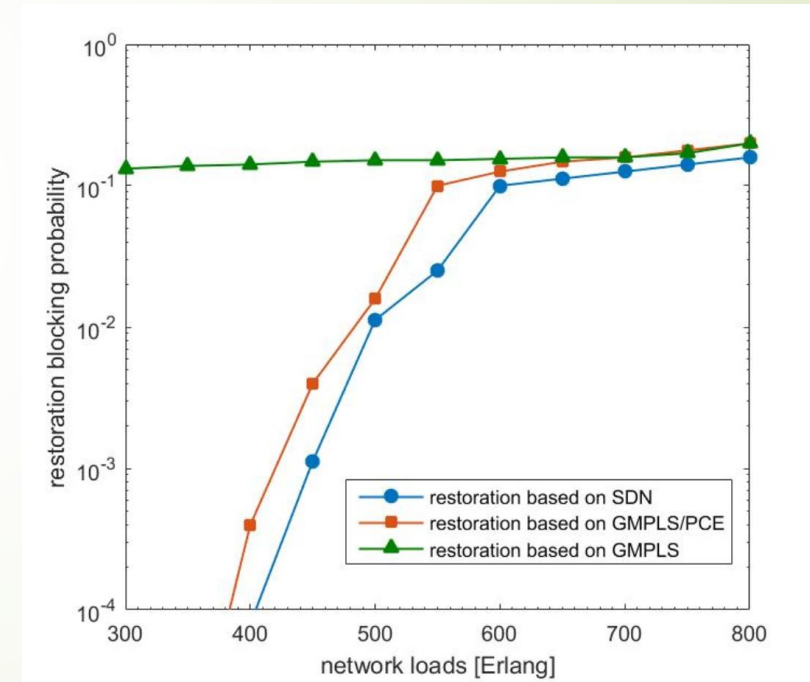
- Simulation Topology



In this section, we evaluate the recovery time and restoration blocking probability during the recovery message transmission in the restoration process.

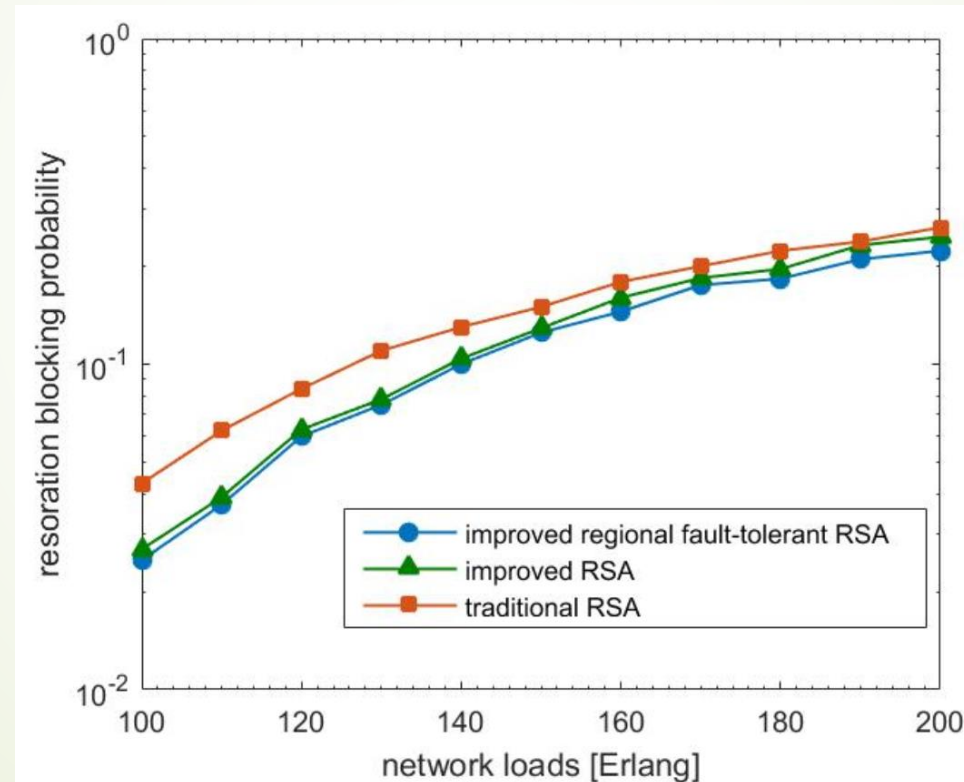


(A)

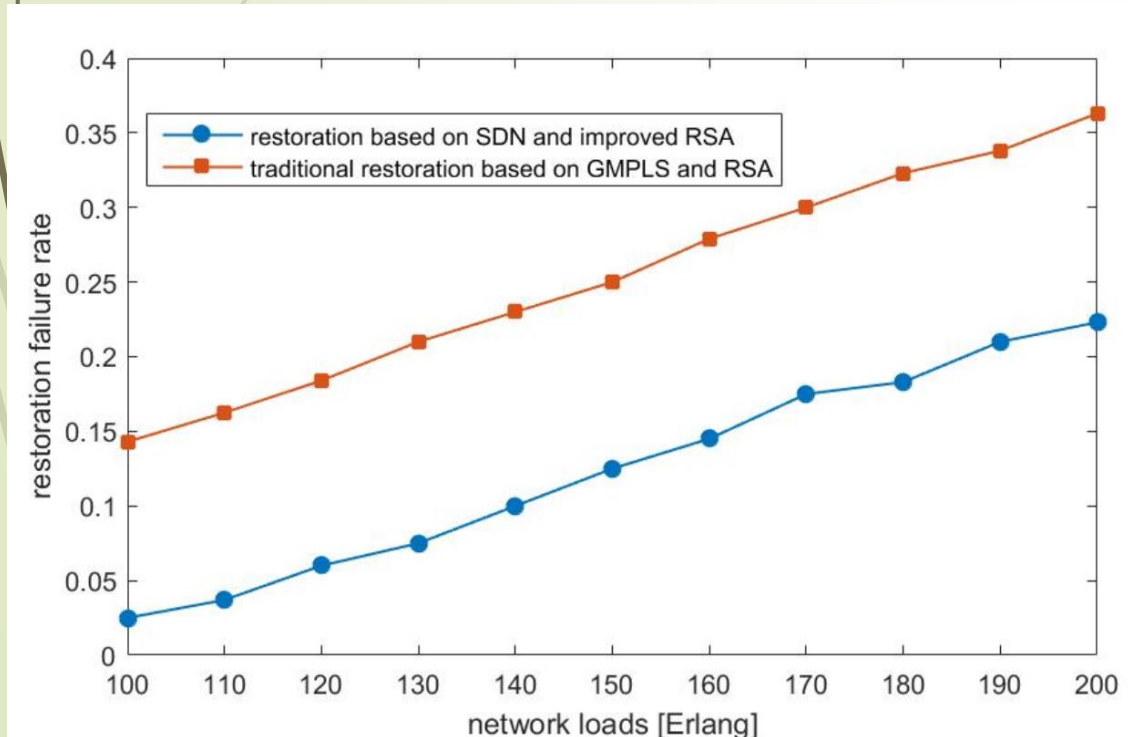


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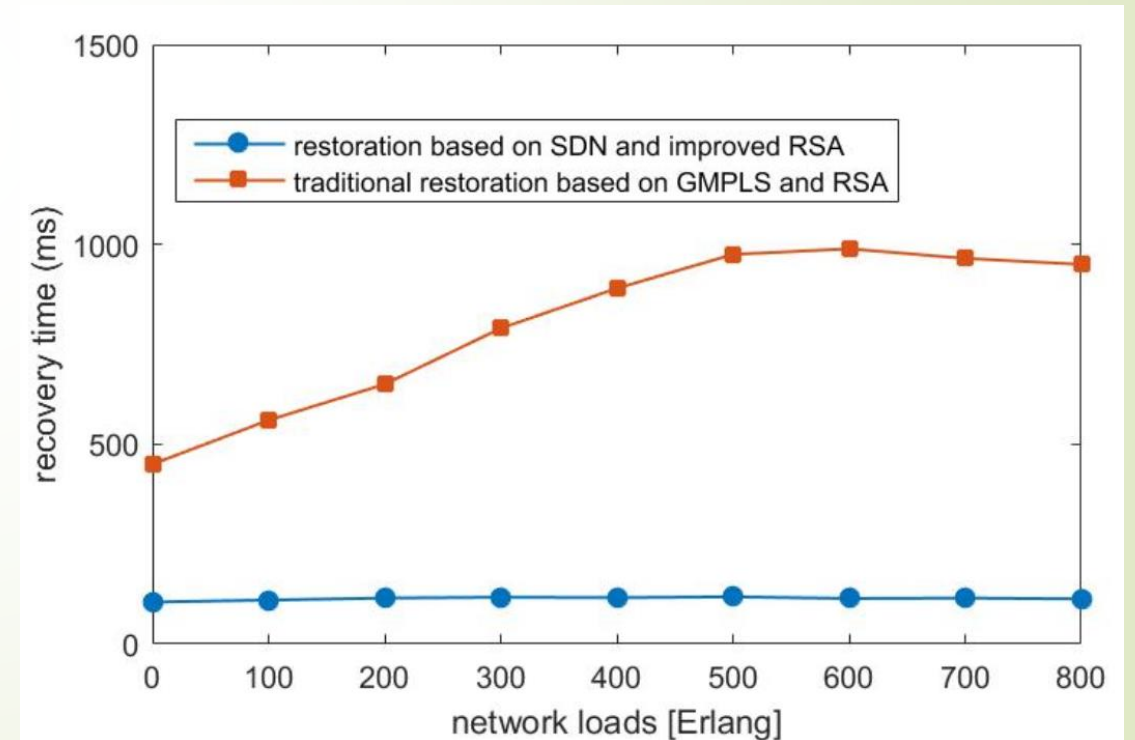
From this figure, we can know that the restoration blocking probability of three schemes increases as the network load increases.



The entire restoration performance is discussed in this section. The two schemes we choose are restoration proposed in this paper and traditional restoration based on GMPLS, respectively. The results are shown in the figure.



(A)



(B)



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- **What we have done**

- We propose a new restoration scheme based on SDN and regional fault-tolerant improved RSA algorithm to ameliorate original scheme.
- The new dynamic restoration not only avoids two contentions and future failures probability, but also reduces recovery time and restoration blocking probability.

- **What we are going to do**

- During message transmission in process, we need a more efficient message format.
- How SDN controller and PCE handle a large number of network requests is also a question we need to consider.





# **Thank you for listening!**