Flow Scheduling in Datacenten Network

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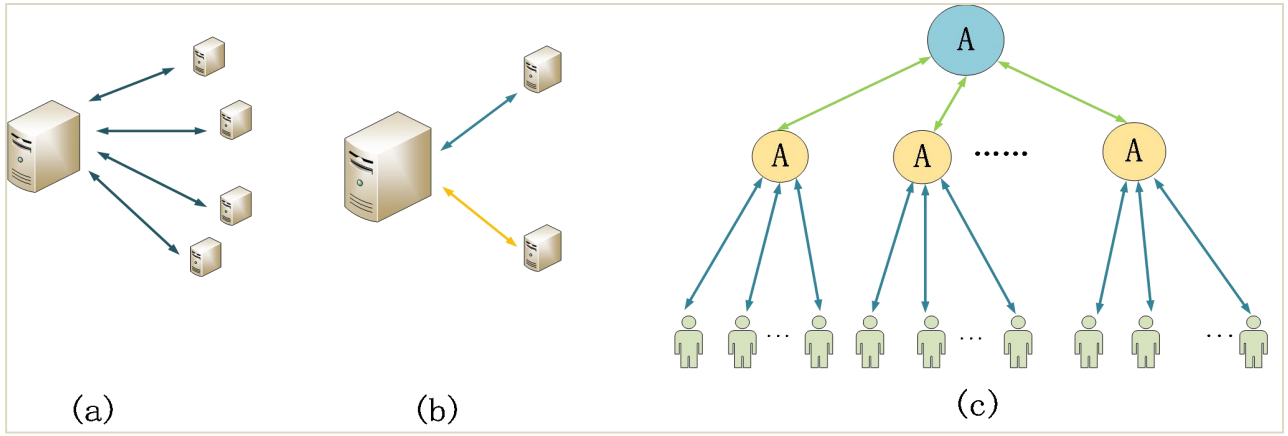
Backgroung

- **What is Datacenter Network?**

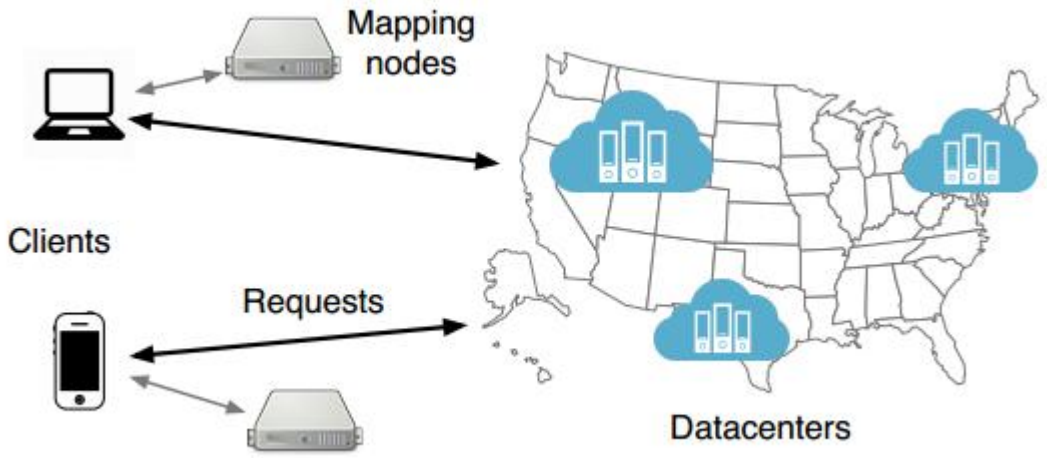
- A datacenter is always composed of some servers and some switches.
- The fabrics of datacenter network is various. But the most used fabric is the tree structure. Each tier provides network transporting of the components below it.



Backgroung

- Many cloud service providers (such as Amazon, Microsoft, Google) have their own datacenters. And these large enterprises increasingly want to build a high-performance datacenter for computing and storage.

- Flow scheduling is the core problem of the datacenter network.



Flow Scheduling models

- **Flow scheduling** is the core problem of the datacenter network.

- There are many tasks coming to the switches every time. Many flows form a task. To get a better perfomance of the datacenter, we need to determine at each timestep which flows can be transmitted and which races these flows will be transmitted through. And we also need to make a better resource allocation. These are called flow scheduling.

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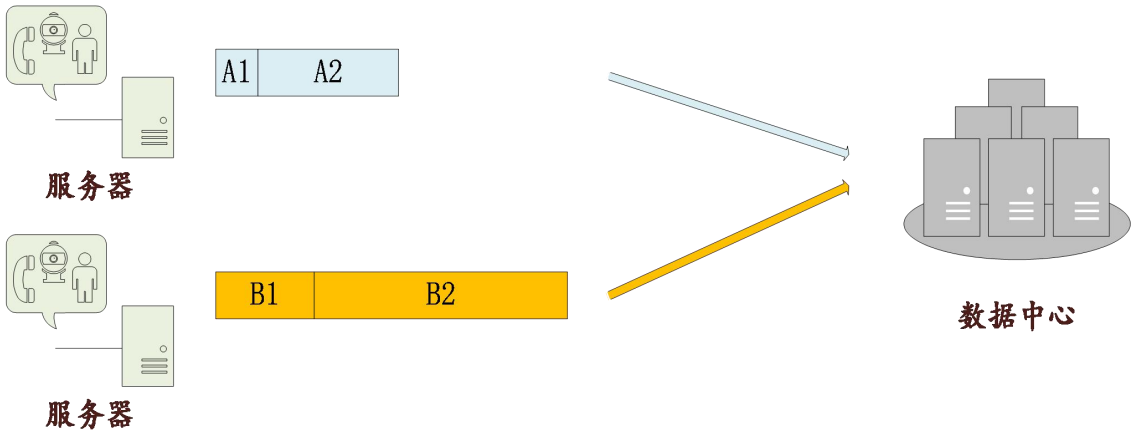
Our model

- **Queue in terms of task.**
- The performance of the system is related closely to the tasks, not the flows. In other words, just when the task is finished, the demand of the user is met.
- And if we queue in terms of task, the completion time of task will be shorter.

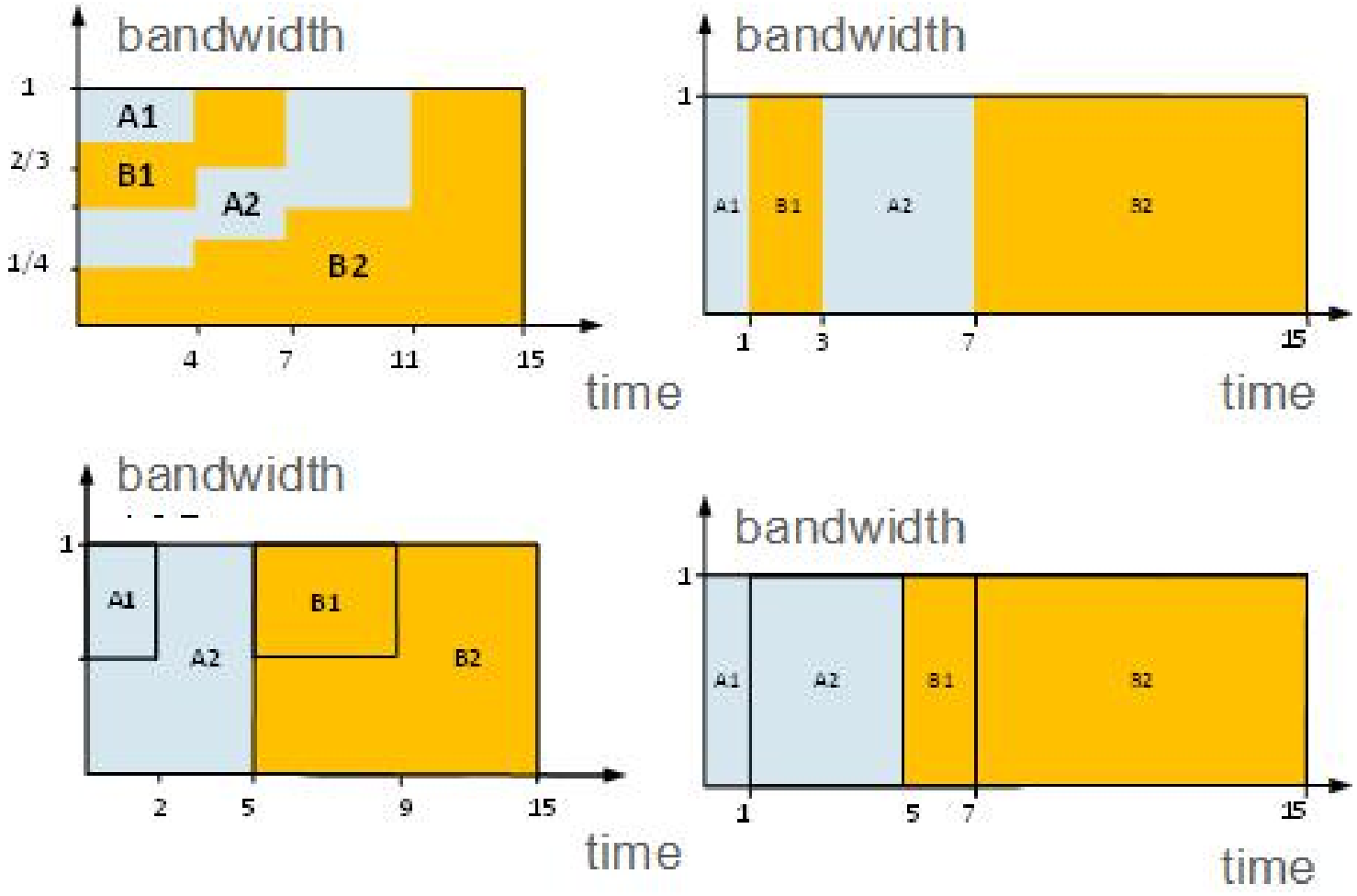
Our model

- **For example**



Task	Flow	Flow size
A	A1	1
	A2	4
B	B1	2
	B2	8

Our model


bandwidth
1
2/3
1/4
A1
B1
A2
B2
4
7
11
15
time
bandwidth
1
A1
B1
A2
B2
1
3
7
15
time
bandwidth
1
A1
A2
B1
B2
2
5
9
15
time
bandwidth
1
A1
A2
B1
B2
1
5
7
15
time

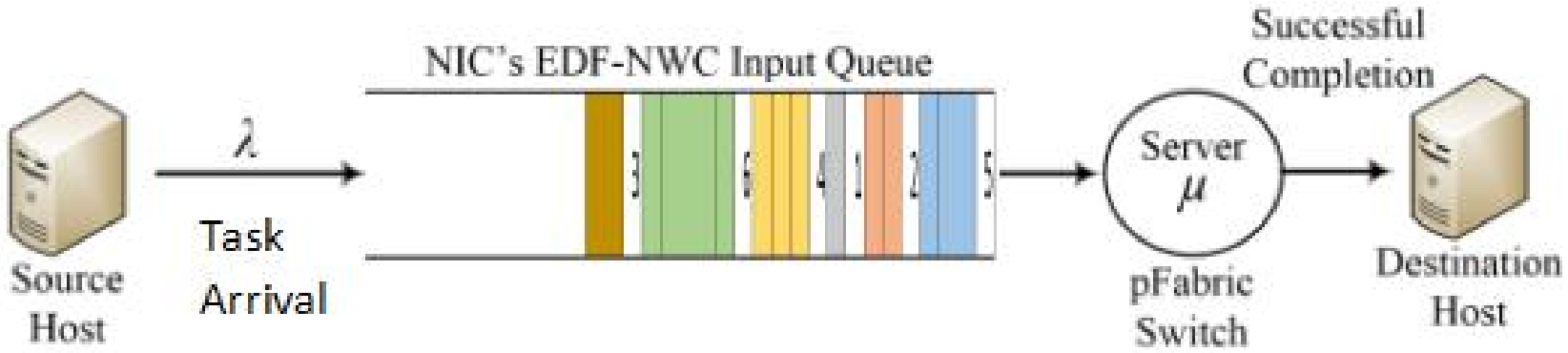
Our model

- **Evaluation result**

Our model

- **Two-dimensional Queuing Model**

- Consider switches as a giant switch.
- Get the priority of the task according the size of all the flows in the task and the number of the flows in the task.
- Smaller size -> higher priority. More flows -> higher priority.
- When get the priority of the task, we first consider the size of the task.



Our model

- **Two-dimensional Queuing Model**
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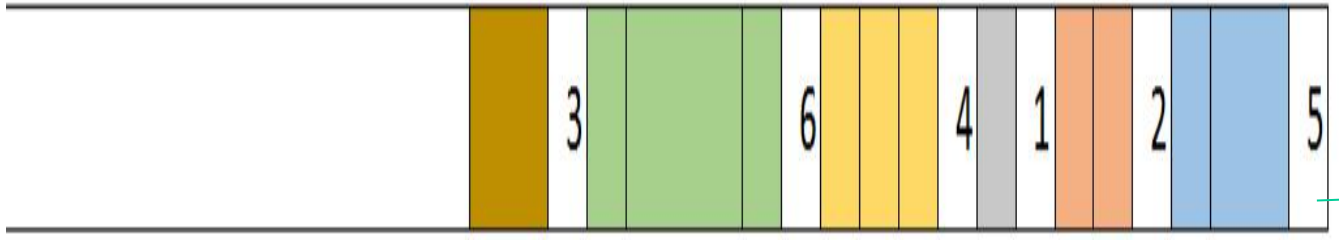


The task which has the smaller size has the higher priority

priority

This two task have same size, so the one having more flows will has the higher priority.

A task have two flows. The flow have diffirent size.

Our model

- **Two-dimensional Queuing Model**

- Why the number of the flows in the task will influce the performance of the task?
- This is because the more flows are in the task, the more likely they may interleave with each other.

Our model

- **Two-dimensional Queuing Model**

- Code: task-id(a,b) for each task.
- a -> the priority related to the size of the flows.
- b-> the priority related to the number of the flows.

Our model

- **Objection Function**

- The complition time of all the tasks.

$$\min CCT = \frac{1}{N}\sum_{i=1}^{N}(t_k + w_k)$$

where t_k is the serving time of task k.

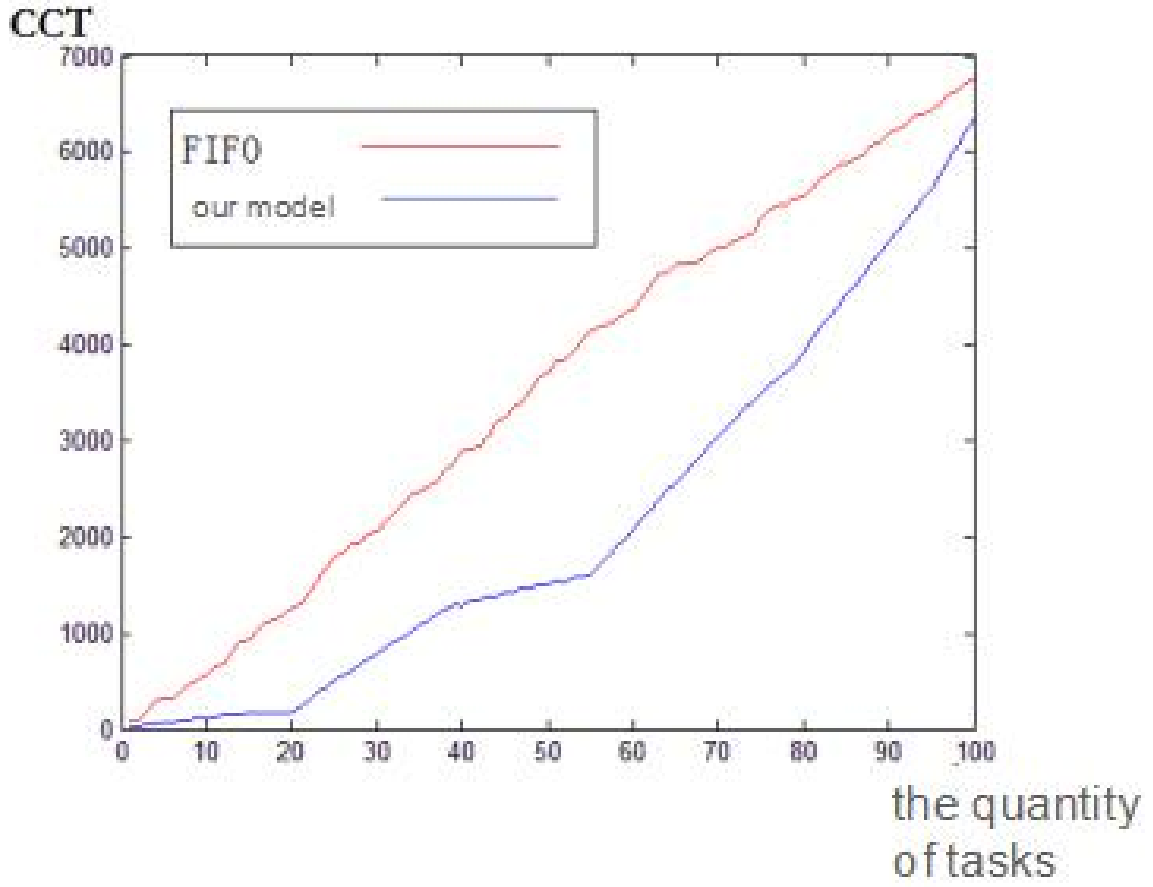
and w_k is the waiting time of task k.

$$t_k = \sum_{f_j \in T_k} \frac{s_{kj}}{r_k}$$

$$w_k = \sum_{id(j) < id(k)} t_j$$

Our model

- **Evaluation**



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Future Work

- In the future, we will use the system welfare instead of completing time of tasks to describe the performance of the system. But this system welfare is related to the comletion time of the tasks.

Q & A