Load Balancing in distributed Openflow Controllers

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Load Balancing in Distributed Controllers

We shall discuss the outcome of implemented switch distribution models.

- Round Robin distribution
- Weighted Round Robin
- Ranking of Controllers

Implementation of Models

Used Modelling and Simulation concepts

- Flow Requests generated using exponential random variables.
- Response time of controller simulated using lognorm random variable.
- Number of active connections varied randomly between 1-50
- Controller uptime assumed to be uniformally between 95.00% to 99.99%

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Model	fr=1000	fr=10000	fr=100000
Round Robin(RR)	0.899	0.921	0.956
Weighted RR	0.912	0.946	0.973
Least response time	0.964	0.953	0.917

fr=Flow request n=20 (Number of controllers)

Proposed Model for Load Distribution in controller-Balance bound

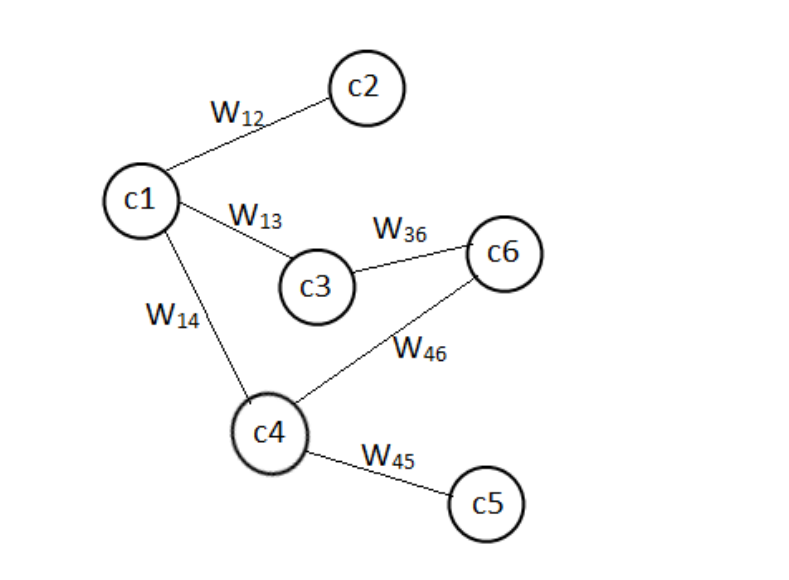

Figure: Fig: A distributed controller network

Model to distribute k switches among n controller:

- **Step1** Generate a list of connected controller (neighbours) per controller.
- **Step2** Calculate the weights of links between each controller

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$$W_{ij} = (t_j - l_j) - (t_i - l_i)$$
$$W_{ij} = -W_{ji}$$

- For every controller, create a max heap which maintains a heap of relative weights.

The heap of controller updates dynamically on fixed interval. i.e. if any controller is disconnected, it is removed from global weight distribution heap.

Continued..

- **Step 4**:

K = number of switches, i=0;

H_k = Heap of Controller id (C_{id}) and (t_i-l_i) values of all controllers. (t_i-l_i) values are used to build heap.

```
While (i<=k){
        cid,(ti-li) =Extract Max (cid, (ti-li))
        If (lcid + fi  <  tcid)
            add flow request f to Cid
        else
            {
            Choose the cid from Max element of max-
            heap of controller Cid.
            Ensure the chosen controller lcid + f  < tcid
            Inform the switch of chosen controller.
            }
        If(cid==NULL)
            Discard flow request if no such controller
            found
        Else
            i=i+1
}
```

Continued..

- It takes constant time to allocate controllers even in cases when controller is reaching it maximum load bound or any controller is down.
- $O(n^2)$ to create the connected neighbour list.
- $O(nlog(n))$ for global and local max heap creation.
- $O(1)$ for getting max element from heap.

Conclusion & Future work

- It takes constant time to allocate controllers even in cases when controller is reaching it maximum load bound or any controller is down.
- Around 20 controllers are sufficient to handle most of average sized network.
- Of all the distribution techniques implemented, Weighted round robin seems to distribute load in better way if weight are adjusted properly.
- Implement the proposed technique in Openflow

End of presentation

- Thank You...Any Questions?