Distributed Control Plane Architecture to support Millisecond routing convergence

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Agenda

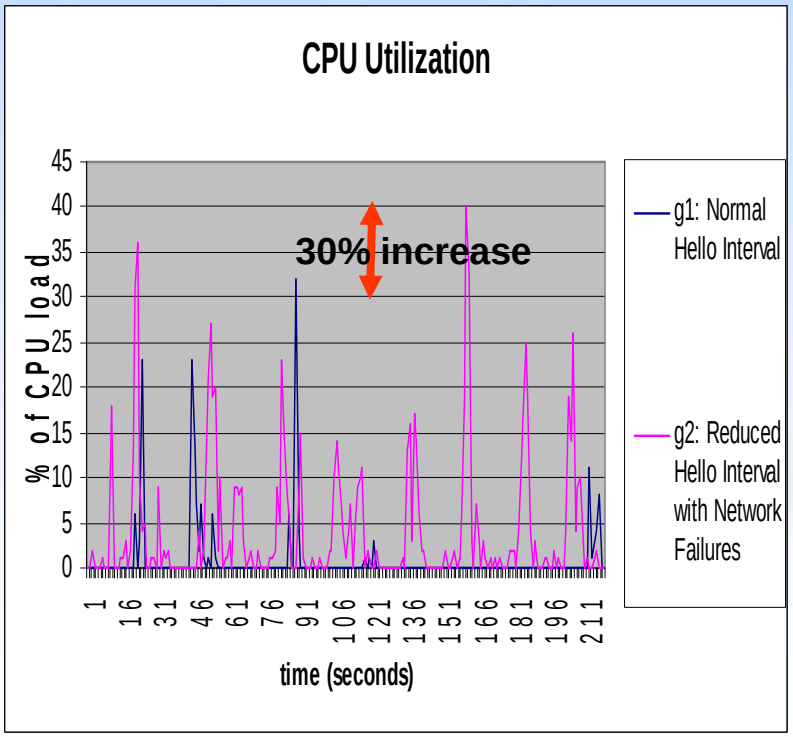
- Motivation
- Possible Solutions for sub-second convergence
- What is Distributed Control Plane Architecture?
- An example…Distributed OSPF
- Summary

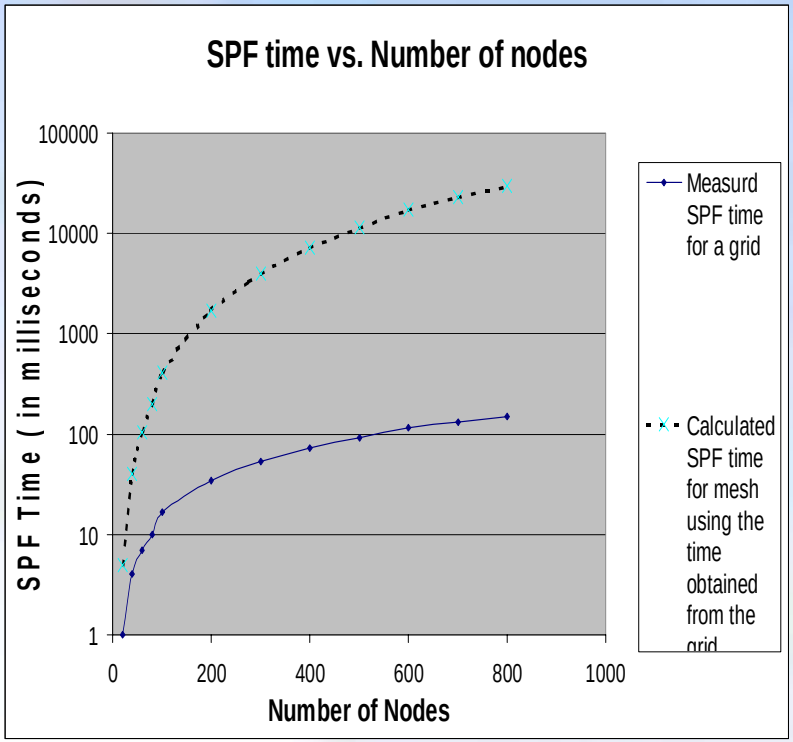
Motivation for Sub-second IGP convergence

- **Faster Link Speeds**
  - **Delayed detection of faults is costly**
  - **Over-provisioning is costly**
- **Increased Network Reliability**
  - **Important for supporting critical services like Video streaming for medical applications**
- **More cost effective compared to Layer 2 protection schemes like SONET**
- **References – http://www.nanog.org/mtg-0010/igp.html, http://www.nanog.org/mtg-0202/cengiz.html**

Difficulties in achieving sub-second convergence

- Millisecond hello interval will increase load on C-Plane CPU, e.g. need to process 600 hellos/sec for 100 interface router
- Dijkstra's SPF Algorithm complexity is e*log (n)





- Experiments conducted at Intel using Moy's OSPF code

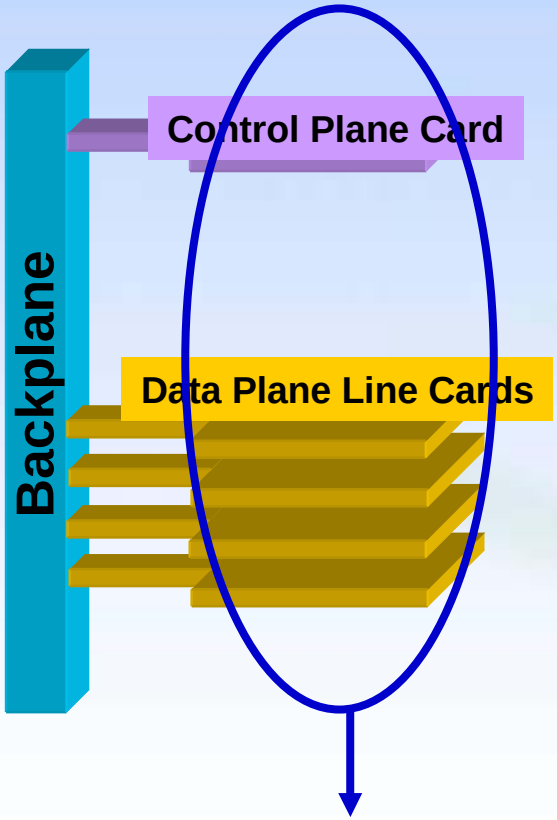
Possible Solutions for sub-second convergence

- Replace IP routing with fast convergence protocols e.g. MPLS Fast Failure Recovery

- Enable sub-second IP routing convergence by
  - Reduce the Hello/Refresh timer intervals
  - Changes to existing routing protocol specs to use faster algorithms for SPF calculation – OR –
  - Distribute functionality of existing protocols to reduce Control Plane CPU load

What is the Distributed Control Plane (DCP) Architecture?

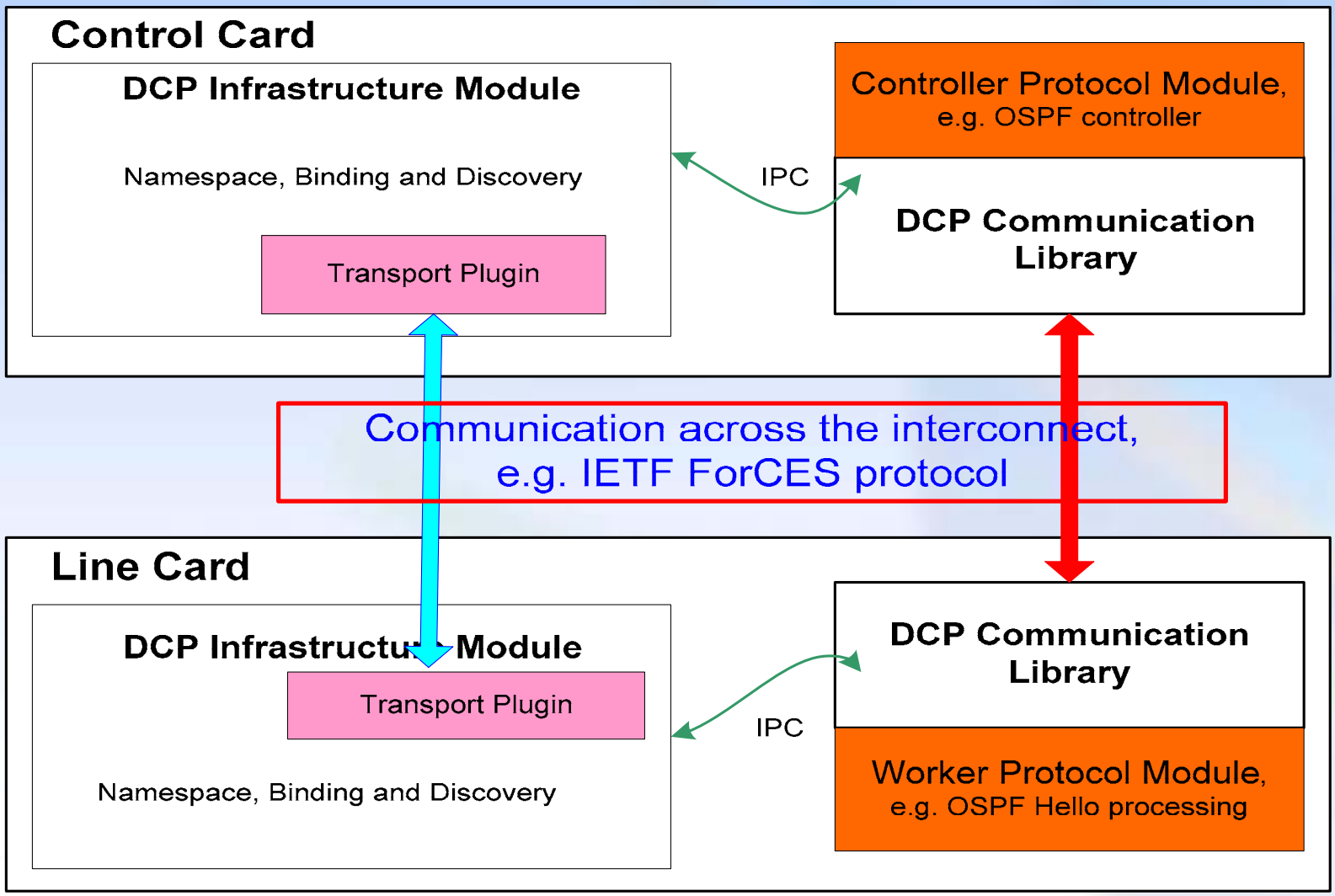
An architecture that enables seamless distribution of protocol functions across multiple processor levels in the system



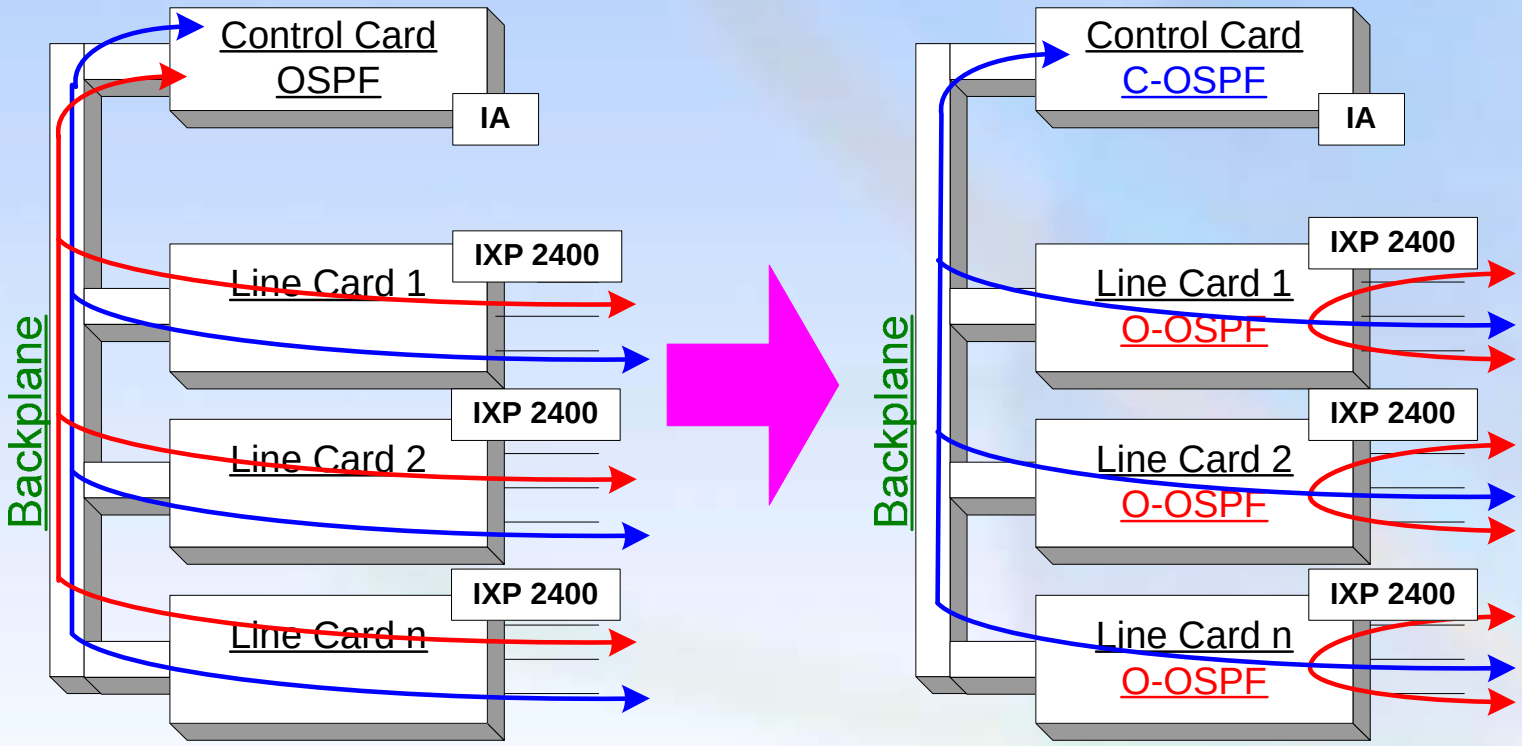
Protocol distribution between Control and Line Cards in Network Element

- **Scalable across multi-tier processor hierarchies**
- **Control Protocol independence**
  - **Provide common primitives**
- **Interconnect independence**
  - **Support for multiple backplanes**
- **Modular extensible architecture**
  - **Well defined interfaces between protocols and other components**

DCP Software Architecture



An example…Distributed OSPF



Hello Traffic

Remaining OSPF Traffic

O-OSPF Offloaded OSPF

C-OSPF Centralized OSPF

Summary

- **Distributed Control Plane Architecture facilitates**
  - **Sub-second IGP Convergence**
  - **Scalability**
  - **Faster fault detection**
  - **Resilience against control plane DoS attacks**
- **Collaborative research by IP Infusion and Intel R&D**
  - **Modular software architecture using IP Infusion's OSPF stack**
  - **Multi-tier IA, IXP processor based hardware architecture**
- **DCP Framework can be used to improve performance of control protocols such as OSPF, IS-IS, BGP**
- **For more information,**
  http://developer.intel.com/technology/itj/2003/volume07issue04/art05_control_plane/p01_abstract.htm

Questions ?

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