



The Next Generation of Internet Interconnection

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Commercial Internet eXchange



Overview

- Update on IXPs
- Developments with service providers
- Interconnection directions



Update on IXPs

- Transition of the CIX Router
- Types of interconnection arrangements:
 - Multi-lateral; Bi-lateral;
Direct interconnection
- Trend
 - Large service providers withdraw from IXPs
 - Preference for direct interconnection



Update on IXPs

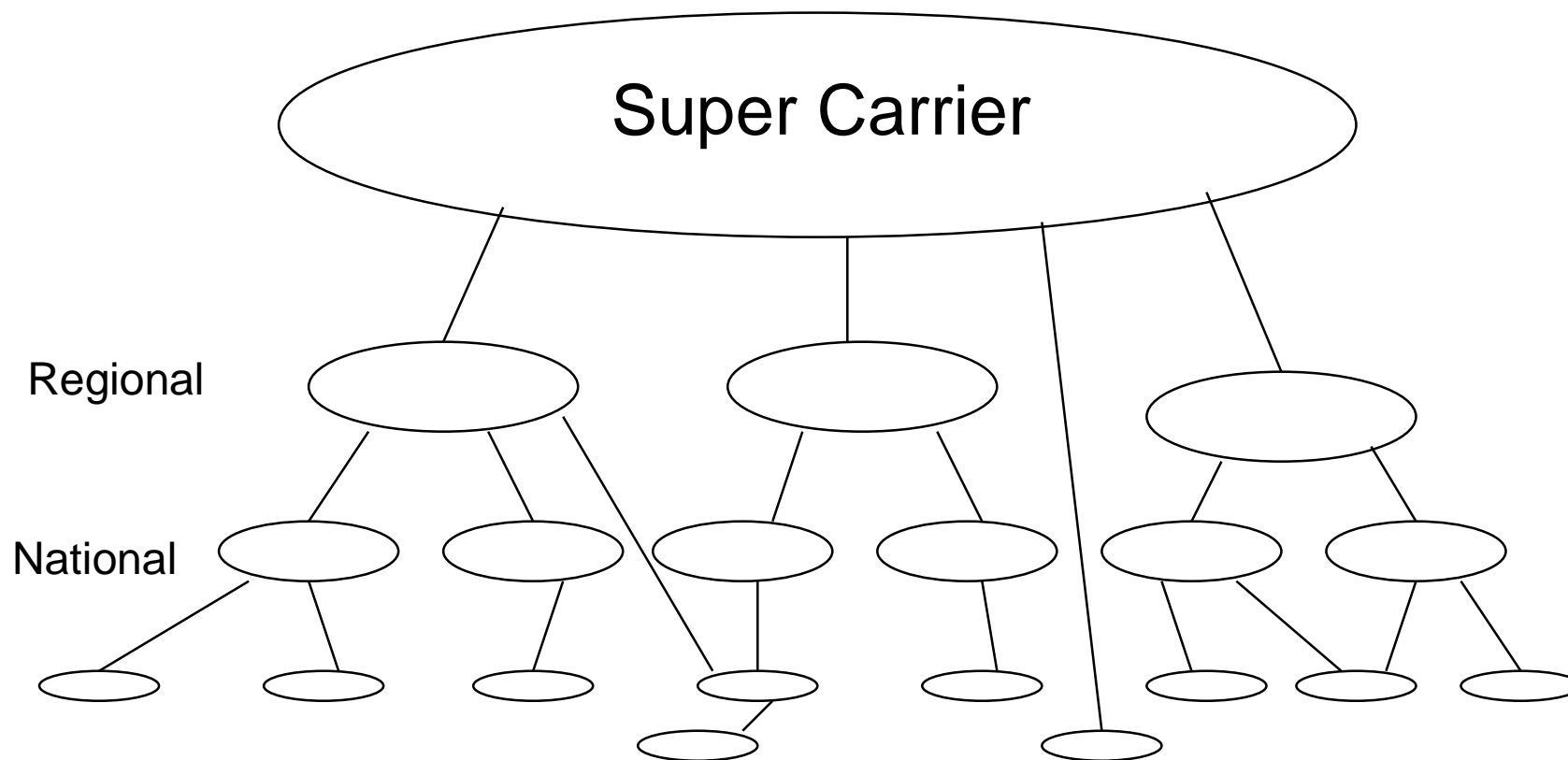
- ~150 IXPs worldwide
 - Growth of IXPs has slowed in key regions
 - Mix of interconnection models in use
- Continued importance of service provider neutral facilities for interconnection



Update on IXPs

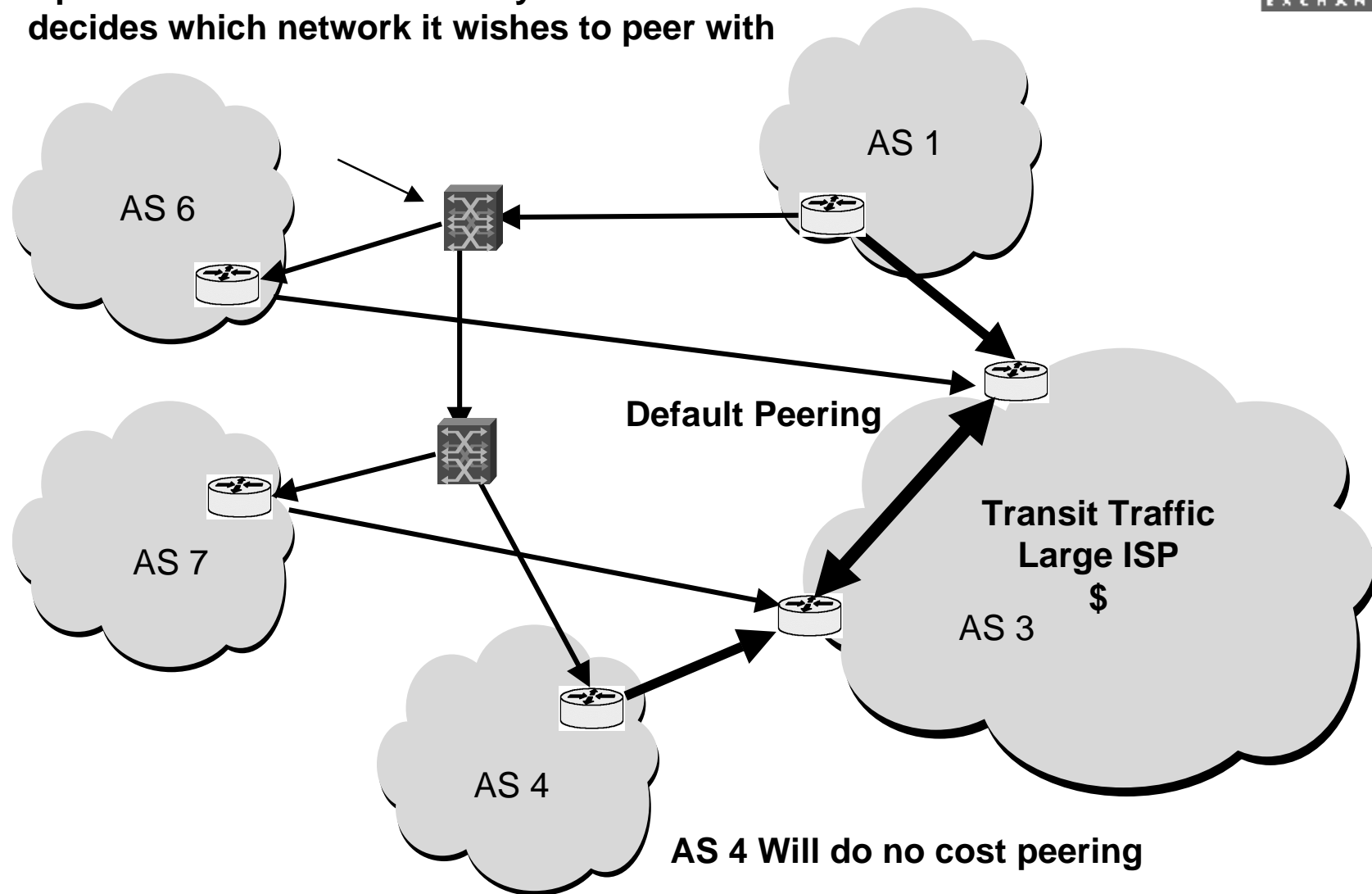
- **10/100 Ethernet, FDDI**
- **ATM OC3/12**
- **Gigabit Ethernet**
- **Private Copper/Fiber Cross Connect**
- **SONET**
- **Frame Relay - OC48/192**
- **10Gigabit Ethernet**
- **Optical Switching**

Developments with Service providers



BGP Peering Tomorrow

Optical switch is controlled by AS 1 who decides which network it wishes to peer with





Internet eXchange Point Developments

- The next generation routing protocol where the control of optical routing and switches across an optical cloud can be managed by the customer network.
- Traditional BGP gives no indication of route congestion or QoS, but with DWDM wave lengths edge routers will have a simple QoS path of guaranteed bandwidth.
- May offer new opportunities for equitable sharing of cost of interconnection.
- Potential growth in direct interconnection may have very positive impact for the implementation of service levels and new applications



References

- Intercontinental and national interconnection:
Hubs and Spokes, Telegeography 2000
- Geoff Huston APECTEL
- Optical BGP documentation and updates on
Canarie project <http://www.canet3.net>
- Equinix—current IX developments
<http://www.equinix.com>
- Interconnection and Pricing Models:
-- <http://www.nanog.org/mtg-0010/tree.doc>
-- Internet Interconnection and the Off-Net-Cost Pricing Principle
Laffont, Marcus, Rey, and Tirole