

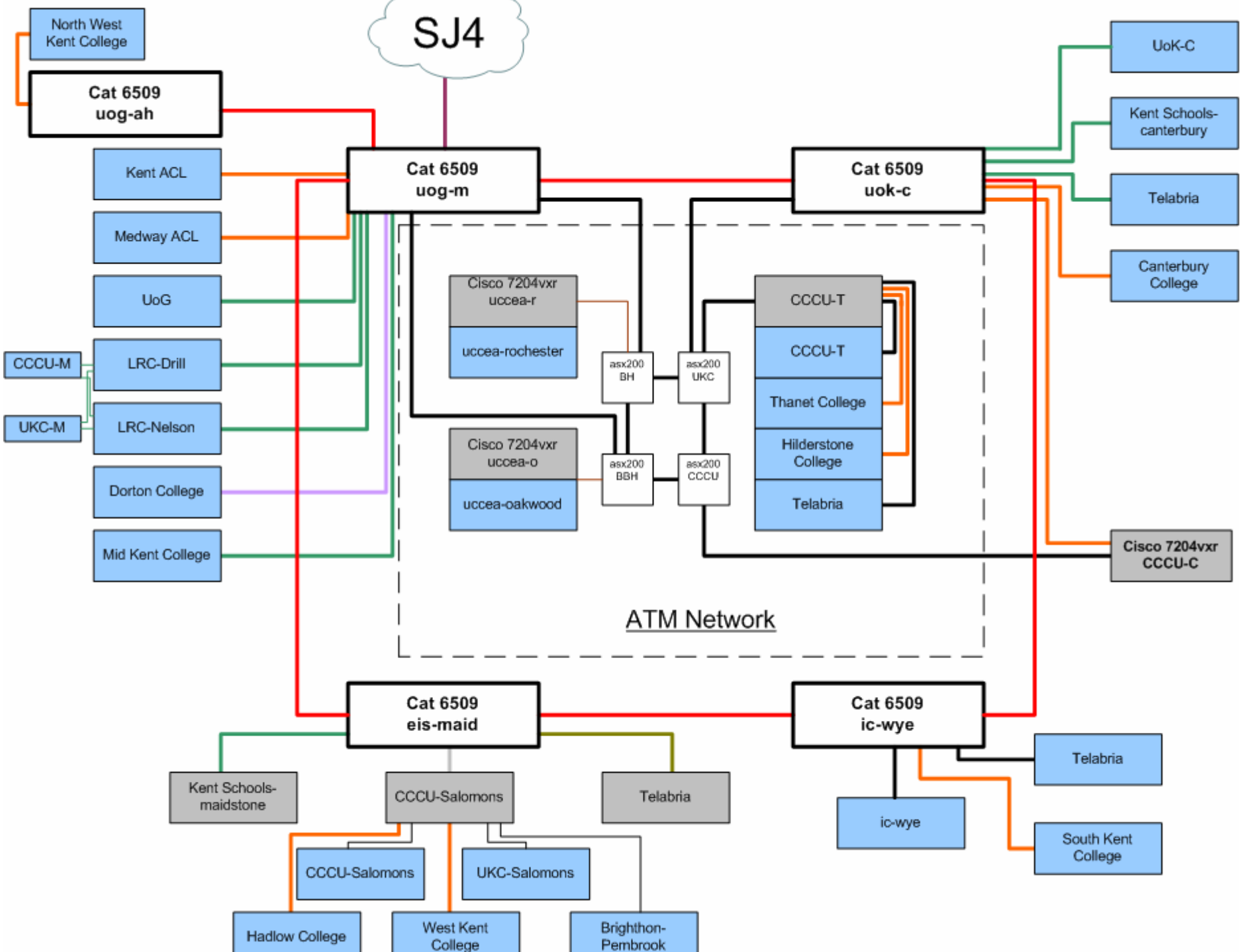
Routing, BGP

Overview

- Kent MAN router interconnect
- Routing Tutorial
- Routing Protocols used within Kent MAN

Kent MAN Interconnect

- ATM LANE to ATM PVC's
- Remote sites: Radio links to Short Haul data circuits
- ATM 155Mbps to Gigabit Ethernet Backbone –BT wavestream circuits



Routing Tutorial

What does the router do?

Router finds a path and forwards the packet:

- **Routing**: building maps and giving directions
- **Forwarding**: moves packets between interfaces

Path choice and Forwarding

- **Finding the Path**

- The path is derived from information received from a routing protocol
- If several paths exist the best next hop is stored in the forwarding table
- Decisions are updated periodically or as a topology change occurs

- **Forwarding**

- Based on destination forwarding
- Longest match forwarding
 - More specific prefix preferred over less specific

Routing Protocols

What is an IGP?

- Interior **G**ateway **P**rotocol
- IGP is used to link all the routers under a common network administrator
- Within an Autonomous System
- Distance Vector/Link State Protocols
- Examples : RIP, OSPF, ISIS, EIGRP

What is an EGP?

- **Exterior Gateway Protocol**
- Used to convey routing information between Autonomous systems
- Current EGP: Border Gateway Protocol (BGP)
 - Scales to large networks
 - Connect multiple IGPs

IGP vs EGP

- Automatic neighbour discovery
- Generally trust IGP routers
- Prefixes go to all IGP routers
- Binds routers in one AS together
- IGP's aim to keep the IGP small for efficiency and scalability
- Specifically configured peers
- Connecting with outside networks
- Set administrative boundaries
- Connects AS's together
- Carries customer prefixes
- Carries internet prefixes

Building the Routing Table

- **Static** – routes are manually defined
- **Dynamic** – routes learned from a protocol
- Routing protocol updates are exchanged by routers to learn about paths to other logical networks
- Can be bandwidth and/or CPU intense
- Each routing protocol offers features that can make it desirable as part of an internetwork design

Path determination

Based on metrics:

- RIP - Hop Count
- OSPF/ISIS – Interface cost (bandwidth)
- EIGRP – Delay, Bandwidth
- BGP – Complex (attributes)

Administrative Distance

Few Examples:

- Connected interface 0
- Static 1
- External BGP 20
- OSPF 110
- Internal BGP 200

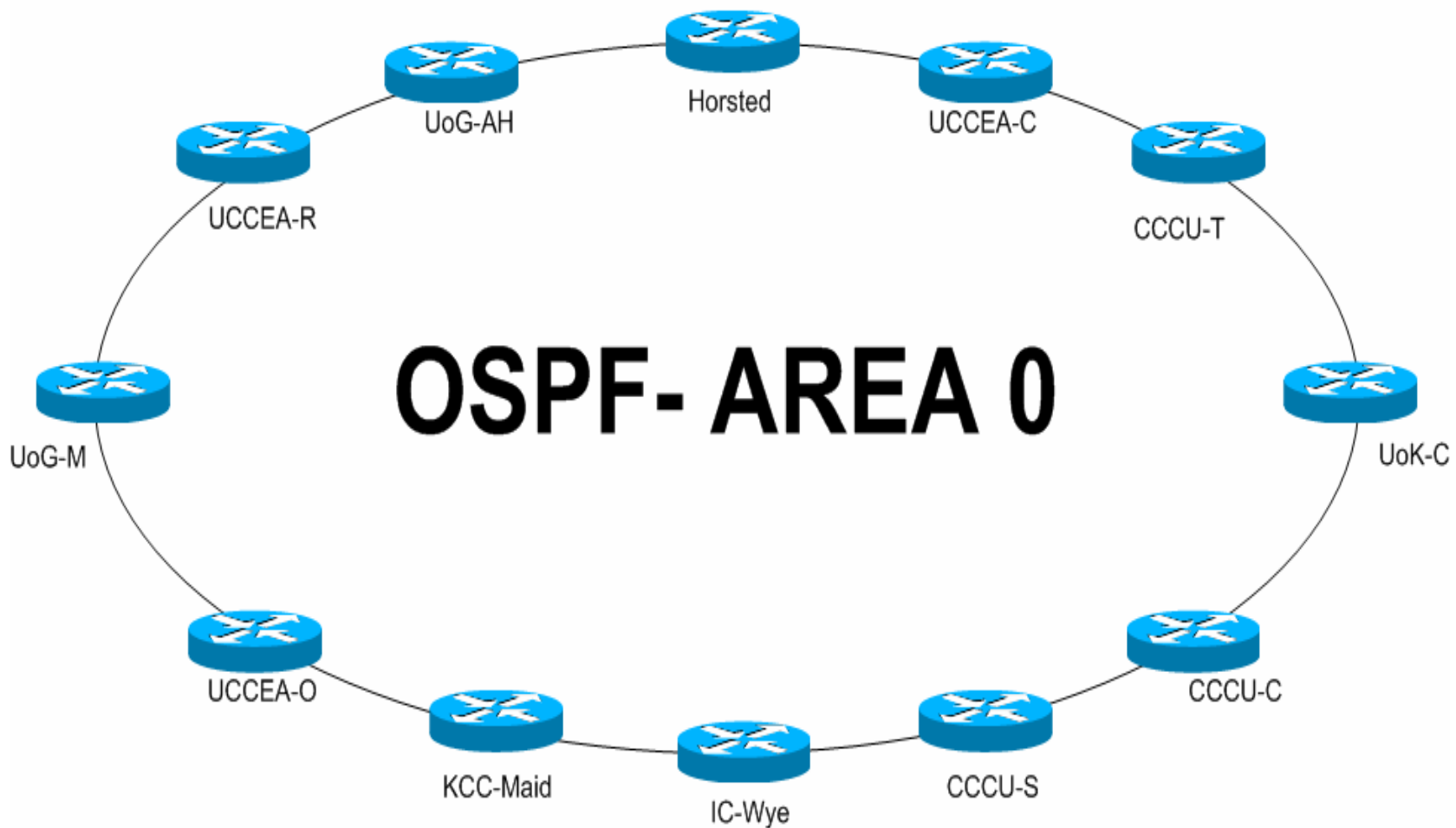
Kent MAN Routing

- **Backbone – dynamic (OSPF)**
- **Single connected sites – static**
- **Multiple connected sites – dynamic (BGP)**

IGP : OSPF backbone

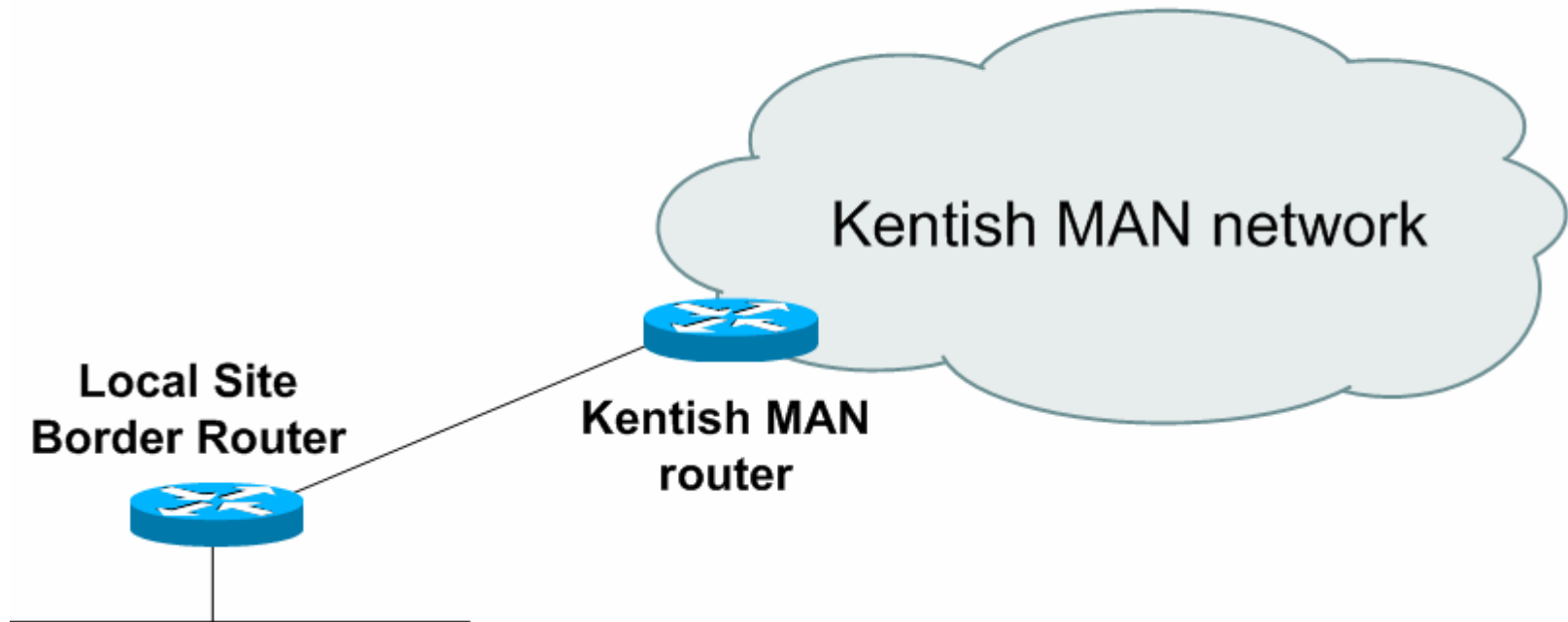
- Fast convergence
- VLSM
- Non-contiguous subnet masks
- No periodic updates
- Engineer paths

Kentish MAN OSPF Backbone



Static Routes to single sites

STUB Network



Kent MAN EGP

- **EGP : Border Gateway Protocol (BGP)**
 - RFC 1771
 - Version 4
 - Policy enforcement
 - CIDR
 - Internet Backbone
 - Autonomous systems
- Used to connect to Janet and to sites with multiple locations: KCN2, UoK, UoM

BGP Policy

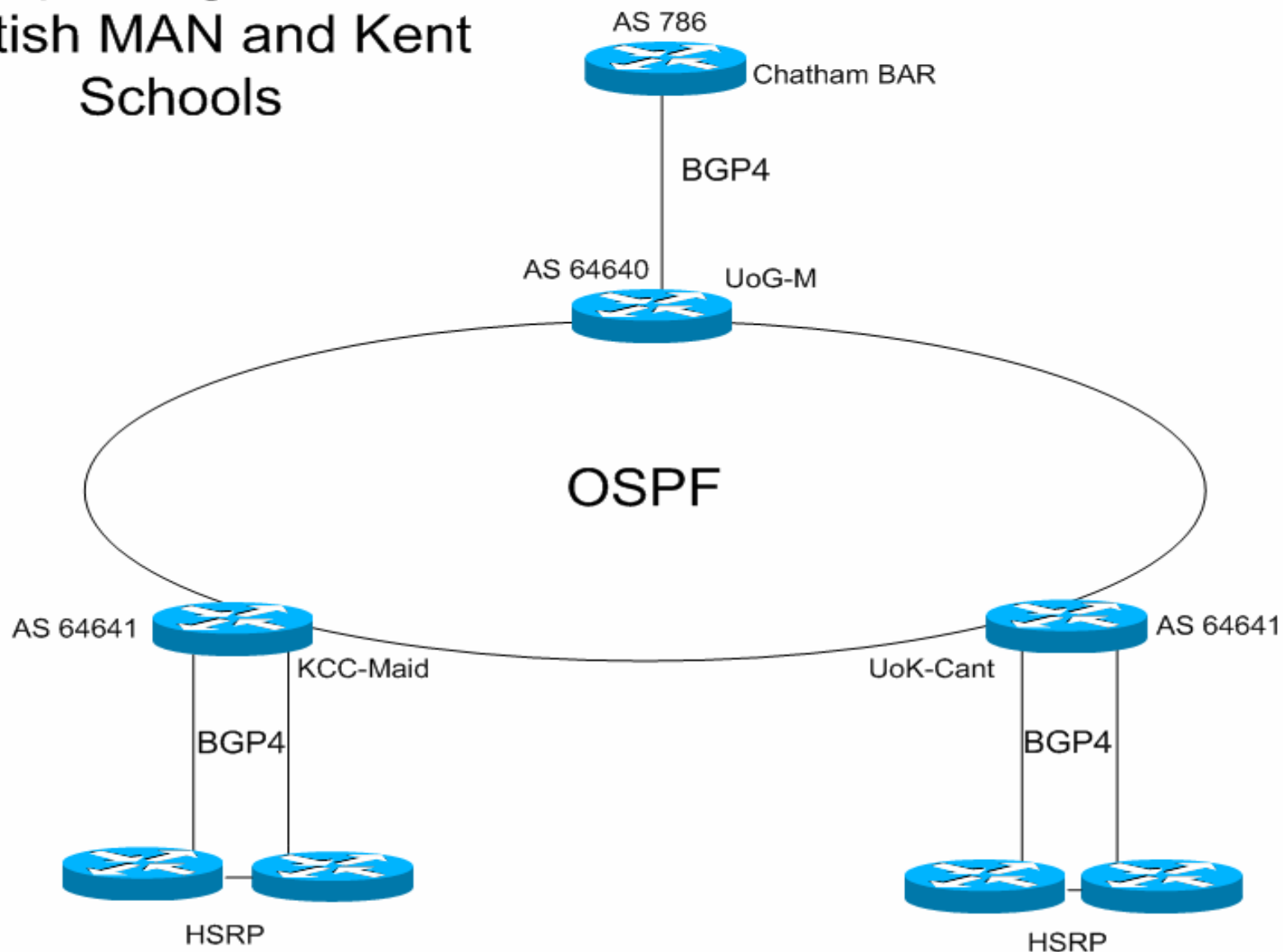
BGP was designed to allow a diverse routing policy. This can be achieved by filtering certain routes, based on prefix, AS path, or other attributes - or by adjusting some of the attributes to influence the best route selection process.

Examples: MED, AS_Path, Local Preference, Communities etc

BGP - Route Insertion Methods

- Network statement - most common
 - Non-scalable
- Aggregate-address statement
 - Summarization
- Redistributing through filters
 - Dangerous as filters are altered

BGP peering between Kentish MAN and Kent Schools



SJ5 requirements for BGP

- Dual entry points into Janet
- All site networks must be reachable via either Regional Network Entry Point (RNEP)
 - Symmetrical in normal use
 - Fallback via Routing Protocol
- RN must choose a policy
 1. All traffic via one RNEP
 2. Traffic via nearest exit point – Kent MAN preference

How can this policy be deployed?

- Use route-maps, add communities to tell which link to prefer for a given prefix
- Outgoing traffic is determined by the IGP
- Incoming traffic is determined by setting the BGP communities on prefixes advertised to Janet

Common problems

- Complexity of each routing protocol
- OSPF: Flapping caused by radio links
 - IPv6
- BGP:
 - Default route
 - BGP Stability : soft-reconfiguration

Useful Tools

- **Looking Glass**
 - <http://alice.ja.net>
- **Whois**
 - <http://www.ripe.net/>
- **Verify DNS**
 - <http://www.dnsreport.org/>

Questions?