Traditional WAN Deployments

- Individual device configuration
- Configuration is not standardized organization wide
- Focus is on link connectivity, not the required performance for applications
- Typically difficult to migrate to another WAN service

SD-WAN

- Cisco acquired Viptela in 2017 to enhance their SD-WAN solution (previously called ‘IWAN’)
- It provides automated setup of WAN connectivity between sites
- Monitoring and failover is automated
- Traffic flow control is application aware

SD-WAN Benefits

- Automated, standardized setup of connectivity between sites
- Transport independent
- Simplified, integrated operations
- More flexibility and easier to migrate WAN services
- The required, predictable performance for important applications
- Integration with the latest cloud and network technologies
- Lower cost

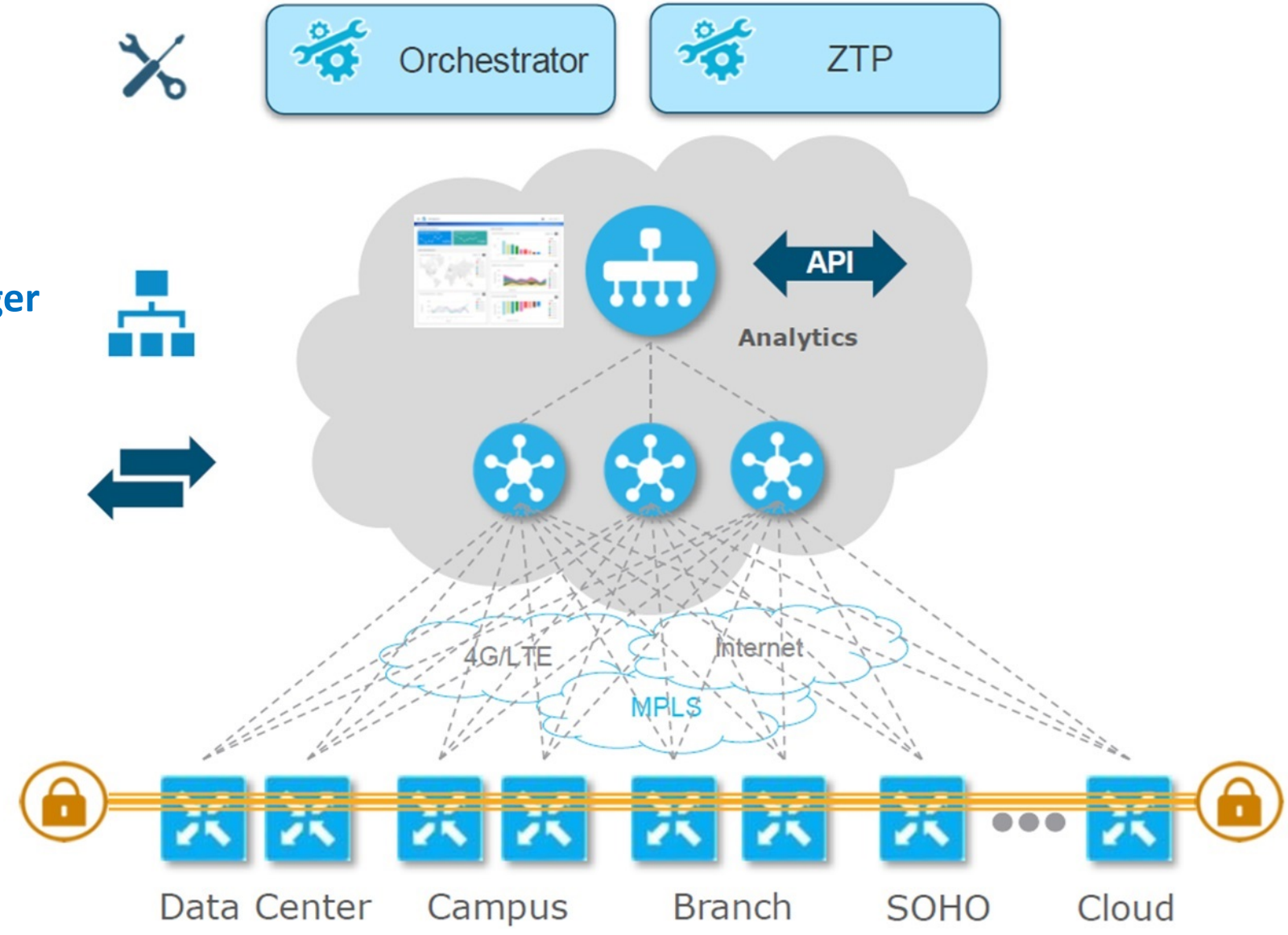
SD-WAN Architecture – Horizontal Scaling

Orchestration: SD-WAN Validator

Management Plane: SD-WAN Manager

Control Plane: SD-WAN Controller

Data Plane: WAN Edge Router



Data Plane – WAN Edge Routers

- WAN Edge Routers (also known as vEdge routers) run the data plane.
- They are physical or virtual routers.
- They form an IPsec encrypted data plane between each other.
- A site can have 2 WAN Edge routers for redundancy.

Control Plane – SD-WAN Controllers

- SD-WAN Controllers (aka vSmart controllers) run the control plane.
- They are the centralized brain of the solution.
- They run as virtual machines.
- They distribute policy and forwarding information to the WAN Edge routers inside TLS tunnels.
- Each WAN Edge router connects to two SD-WAN Controllers for redundancy.

Management Plane – SD-WAN Manager

- SD-WAN Manager (aka the vManage NMS) provides the management plane GUI.
- It enables centralized configuration and simplifies changes.
- It provides real time alerting.
- It runs as a virtual machine.
- Multiple SD-WAN Managers are clustered for redundancy.

Orchestration – SD-WAN Validator

- The SD-WAN Validator (aka vBond orchestrator) authenticates all SD-WAN Controllers, SD-WAN Managers and WAN Edge routers that join the SD-WAN network.
- It enables WAN Edge routers to discover each other, SD-WAN Managers and SD-WAN Controllers.
- It has a public IP address and is deployed in the DMZ.
- It runs as a virtual machine (can also run on a router in smaller deployments.)
- Multiple SD-WAN Validator orchestrators can be deployed with round robin DNS.

ZTP Zero Touch Provisioning service

- Cloud based shared service hosted by Cisco.
- Utilized on first boot of WAN Edge router only.
- Directs it to SD-WAN Validator to orchestrate joining it to the network.

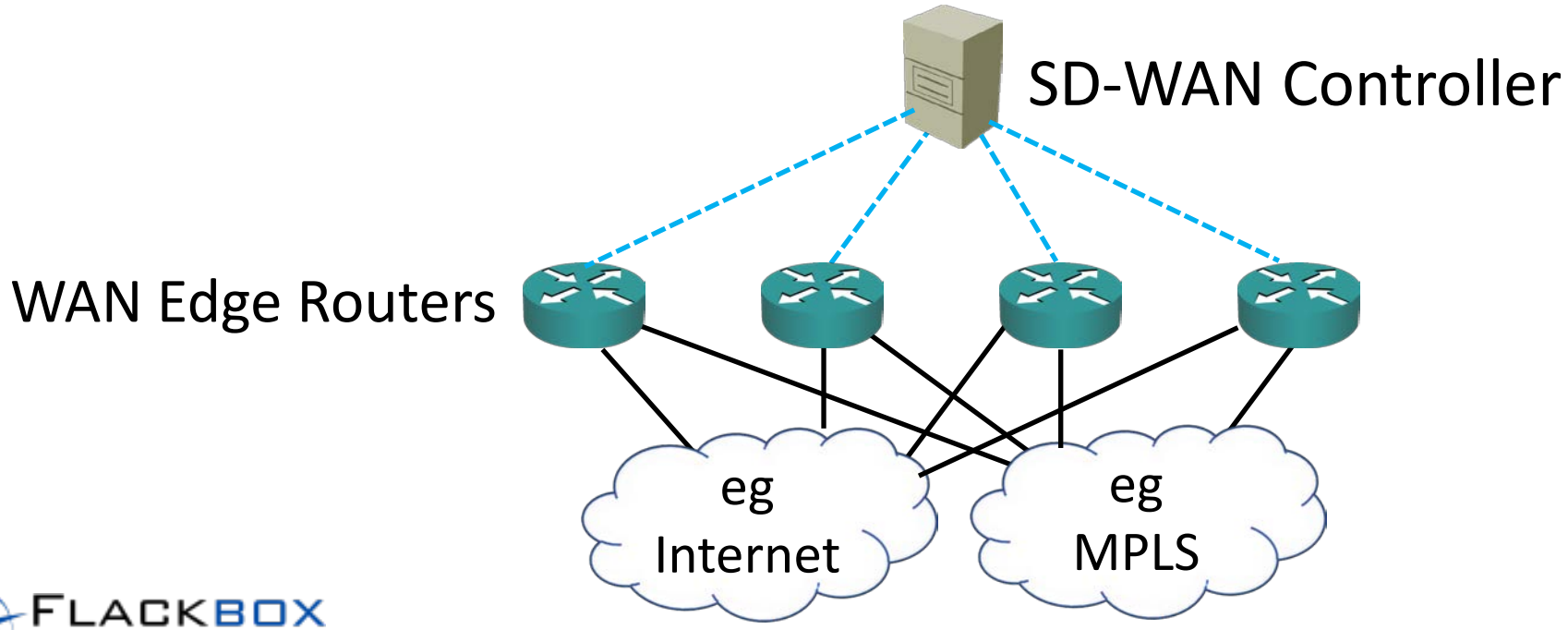
On Premises and Cloud

- SD-WAN Validator, Controller and Manager can be deployed:
  - On premises
  - Hosted in Cisco (or partner) cloud

- Most deployments are in the cloud

Building the Data Plane

- The SD-WAN Controller directs the WAN Edge routers to build a full mesh (by default) of IPsec VPN tunnels between themselves.
- The SD-WAN Controller propagates policy and routing information to the WAN Edge routers with OMP Overlay Management Protocol.



BF VPN Tunnel Monitoring

- Bidirectional Forwarding Detection packets are sent over all VPN tunnels
- This detects if a tunnel goes down, and also provides latency, jitter and loss statistics

Traffic Forwarding Options

- If multiple tunnels are available (for example over MPLS and Internet) traffic can be load balanced over the tunnels:
- Active/Active
- Weighted Active/Active
- Application pinning Active/Standby
- Application Aware Routing

Application Aware Routing

- BFD monitors the latency, jitter and loss across the VPN tunnels
- You can set minimum requirements for an application with Service Level Agreement SLA Classes
- SD-WAN ensures the application is sent over a link which meets its SLA requirements
- By default traffic will fall back to another link if no suitable link is available