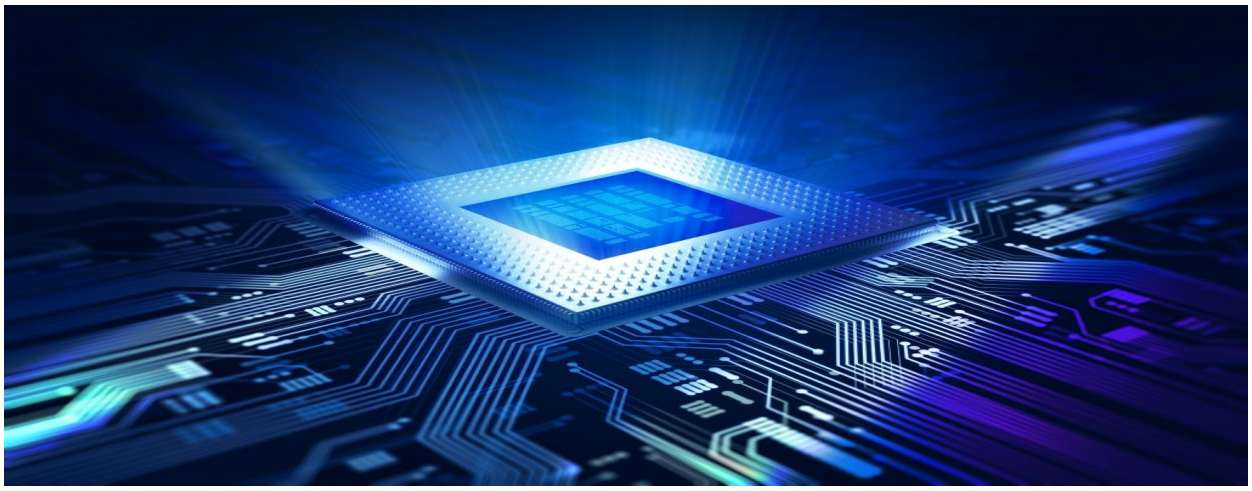
AimValley

Layer 3 Switching
Technology Brief



Enterprise networks are always in a state of continuous growth and evolution. With highly demanding infrastructures, large traffic volumes, applications which squeeze bandwidth and network resources, a balance between quality and demand is required. This is where Intelligent Networking becomes critical. One such evolution was Layer 3 Switch!

Evolution of Layer 3 switching

Layer 2 Switches offer frame forwarding based on the physical addresses (MAC). A network built using Layer 2 switches appears as a *Single Flat Address space.* Hence a Layer 2 network has limited scalability and flexibility. Layer 2 switches are capable of intra-VLAN communication, isolating data transfer between devices within each VLAN, but they lack the capability of inter-VLAN communication and they cannot route packets between VLANs. This brings the need for a Layer 3 device.

Routers, operating at layer 3, offer packet forwarding based on logical addresses (IP Addressing). They use dynamic routing protocols to identify best path to a destination. Traditional routers were slower in forwarding packets when compared to switches.

Layer 3 switches were introduced into the market to efficiently perform inter-VLAN routing augmenting all layer 2 functionalities.

Layer 3 switches are high performance routers optimized for campus LANs or intranets.
A Layer 3 switch is also referred to as Multilayer switch, since it plays a dual role:

- **Switch:** it performs the Layer 2 functionality of connecting devices that are on the same subnet or virtual LAN at lightning speeds.
- **Router:** it connects subnets or VLANs using its IP routing intelligence which makes it act as a router. It can support routing protocols like RIP, OSFP, EIGRP.

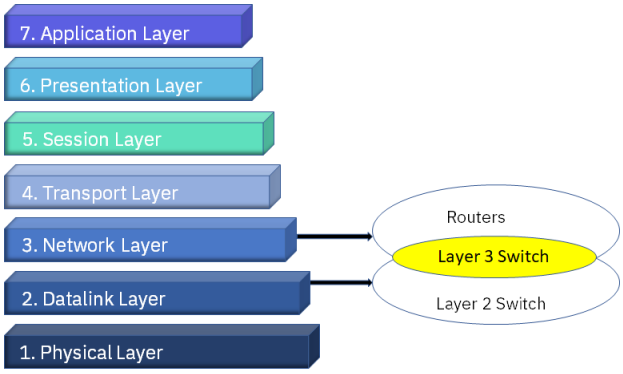


Figure 1: OSI-Model

AimValley

Layer 3 Switching
Technology Brief

Features of Layer 3 Switch
- Packet switching
- Route processing
- Intelligent Network Access Services, like Quality of Service (QoS), Access Control Lists, ARP, DHCP, etc.
- Deployed as backbone of LAN or campus networks
- Improves fault isolation when compared to Layer 2 switch
- Reduces broadcast traffic volumes
- Lower network latency

IP Routing in AimOS
AimValley's Network Software Stack – AimOS has comprehensive support for the relevant standards, with management interfaces and a design suited for the most demanding applications.
It is a portable source code implementation designed explicitly to support the scalability, availability and functional requirements of OEMs building devices for next generation networks.

AimOS IP Routing Highlights
- Hardware assisted IP Routing
- Supports static and dynamic routing protocols
- Integrated Free Range Routing stack (FRRouting or FRR):
  ✔ FRR is a free and open source internet routing protocol suite for Linux and Unix platforms
- Uses Linux network stack
- Station move support within subnet
- Autonomous aging of known-non-active-hosts
- Scales well in large networks
- Mature and field-tested protocols
- Easy to use and integrate with management applications.

Whether you are looking for cost effectiveness, convertible components or robustness, AimValley has the right software to help you design your Ethernet switch seamlessly.

For an overview of our Layer 2 switch experience, please visit our website: AimValley Layer 2 Switch.

Utrechtseweg 38
1213 TV Hilversum
The Netherlands

phone +31 35 689 1900
sales@aimvalley.com
www.aimvalley.com

Architecture

Below Figure 2 depicts the high level software architecture.

Application (AimValley application running on the operating system to manage the L3 switch) maintains IP forwarding tables. It ensures that the hardware forwarding tables are in sync with the ones in the SW.

Hardware is any L3 capable hardware. It routes IPv4 packets using entries in hardware forwarding tables**.** In case of miss, the un-routed packets are sent to ***Host IP-Stack*** (Networking IP stack of an operating system). It handles the un-routed packets from the hardware, performs link-local address discovery using ARP protocol and finally performs software routing of those packets. Also updates the ***application*** of the changes in the IP forwarding tables.

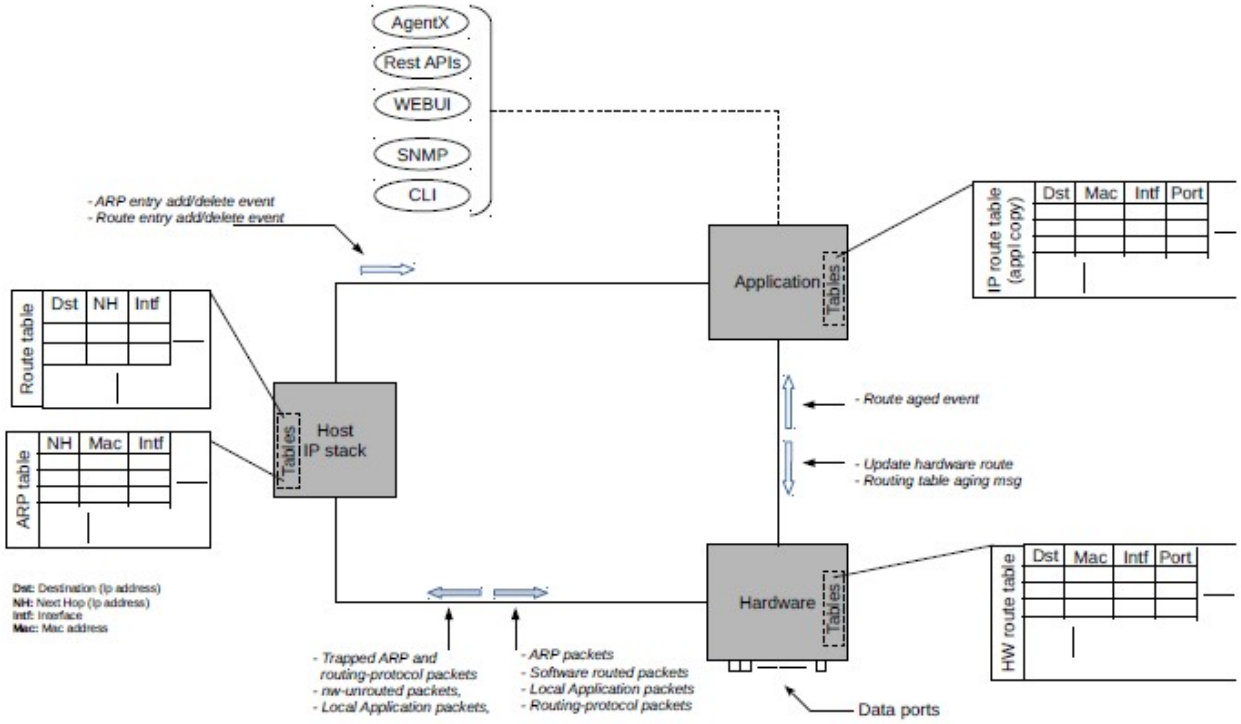


Figure 2: Architecture high level overview

Example use case

In general, L3 switch is required to enable communication across different subnets. A subnet can be a LAN where the physical port identifies a subnet; alternatively VLANs can be used to provide a logical sub-division of the IP network.
Considering this, a typical application of a L3 switch, is to connect different subnets domains in combination with one or more VLAN switches.

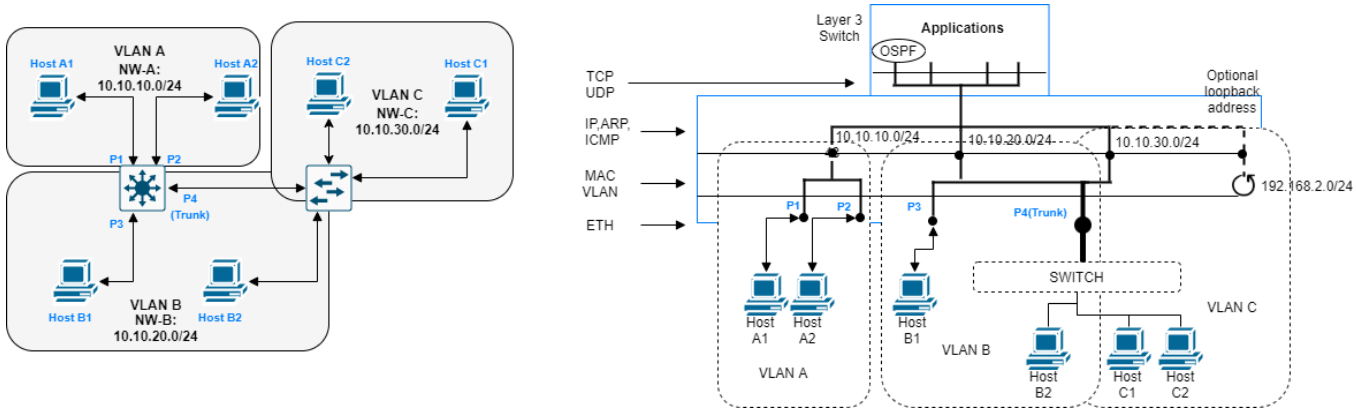


Figure 3: Example network with 3 VLANs

The above figure shows an example network with 3 VLANs (also, we have depicted the IP stack profile of the L3 switch). It presents 6 distributed host systems interconnected by means of VLANs and MAC addresses. The VLANs themselves are interconnected by routing based upon IP addressing.

The L3 switch system itself is reachable via any of the 3 IP addresses, unless special security measures are taken to limit this access. In some systems an extra loopback interface is created. The assigned IP address to this interface can be used as a universal id to reach the system.

In the example above the routing is based upon IP address information which is maintained in the IP routing tables. The routing table defines for each reachable destination the appropriate next hop system (neighbor IP address) and the port to reach this neighbor. The next hop MAC address of the neighbor is determined via ARP. The maintaining of the routing tables is by means of provisioning or by an automated routing protocol.

AimValley
Utrechtseweg 38
1213 TV Hilversum
The Netherlands
phone +31 35 689 1900
sales@aimvalley.com
www.aimvalley.com

AimValley

Layer 3 Switching
Technology Brief

Features	Description
IPv4	Route IPv4 packets (unicast)
IPv6	Route IPv6 packets (unicast) with dual stack support
ARP	Protocol to discover link layer address, such as MAC address, associated with an IPv4 address.
NDP	Protocol to discover link layer address, such as MAC address, associated with an IPv6 address.
Station Move	Detect a station move within a (V)LAN.
ICMP	Protocol to send error messages and operational information to indicate, for example, that a host cannot be reached.
ICMPv6	IPv6 variant of ICMP. Needed for NDP.
DHCPv4 Server	Dynamic Host Configuration Protocol server for IPv4
Static Routing	User configured routing.
Dynamic Routing	Dynamic routing using FRRouting suite.
Routing Re-distribution	Extend the distributed routing information with extra 'external' routing information
IP Statistics	Statistics of IP packets.
L2 Switch	All L2 switch features of AimOS.

AimValley proven track record

Started in 2003, we have delivered over 100 000 deployed systems with customized and varied flavors of AimOS family to different category of customers:

- Industrial applications
- Telecom applications
- Aero-space applications
- Automotive applications

Visit our website for an extensive overview of our AimOS experience.

Why AimValley?

AimValley is a reliable provider of packet switching technology since 2003, delivering solutions for:

- High speed data processing applications
- Complex FPGA-based accelerated systems
- High speed, low power hardware equipment
- Robust embedded software
- Early adopter of Acceleration Technology

AimValley understands the full complexities as well as the subtle nuances of designing great edge solutions. We excel in building complex systems that are part of your product in the fields of Industry 4.0,https://www.aimvalley.com/solutions/ Big Data, Healthcare and Transportation markets. Our combined skills represent all the important aspects required for the development of end-to-end systems.

Our customers enjoy the benefits of working with a strong team with more than 2 000 years engineering experience. AimValley is a trusted partner of Tier 1 customers in Telecom and Industrial markets and has shipped more than 100 000 products.

Quality Focus

- Outstanding track record of on-time delivery
- Best in Class Designs – Time, Budget & Quality
- ISO9001, ISO140001, Ecovadis Platinum CSR

Utrechtseweg 38
1213 TV Hilversum
The Netherlands

phone +31 35 689 1900
sales@aimvalley.com
www.aimvalley.com