

Application Architecture for each Primary Application

Across the four sites, this business utilises 3 primary applications, intranet, email, and IP telephony. Each of these 3 core applications have different requirements, and an application architecture should be chosen to suit it, its expected demand, and its expected traffic patterns and capacity requirements. The business should also carefully consider how the application will scale as the traffic to each application scales, future proofing the core business functions these applications serve.

Intranet

The business' largest site and data center, consisting of over 4000 employees, primarily hosts an intranet application. We can assume that this is most likely servicing productivity, communication, and the sharing of digital resources between the employees of the site and business. This application is critical to the business, will host mission critical data and processes, and an appropriate level of redundancy and scalability must be considered.

A host-based application architecture would be the most appropriate choice for this type of application. Host-based application architectures move the application logic and storage to servers, leaving the less powerful client to manage presentation of the application. This architecture has several benefits, first being its ability to scale through the use of load balancing. Given that the intranet is most likely used to service a large portion of the business' key functions, as the business grows, not only with head count, but also through increases to the number of business functions, applications, and the increase in stored data. Host-based infrastructure scale incredibly well, can balance the load of these ever-growing applications across many servers, taking away the potential client computational power issues as the application grows in complexity. A key drawback of this type of architecture is an increased network complexity and traffic capacity requirement. However, as the intranet is often not used for external use, it can be assumed that this application will be served over a LAN, of which is often very fast, reliable, and secure, alleviating these disadvantages.

As the intranet's predominately serve internal content in the form web-browser, a host-based architecture suits this very well, as browsers bring a lot of overhead and strain on the client device, creating a potential bottleneck. This is another clear reason that a host-based architecture is the most appropriate choice. Transport layers such as TCP and FTP would be the most appropriate choices for the serving, viewing, and another other type of function that an employee might need to use on the intranet. TCP can be used to establish a secure connection with the intranet, used for authentication and standard HTTP requests, allowing for the accessing of the site. FTP is best used for the downloading, uploading, and other kind of action regarding the file system that the intranet manages. These transport layers are critical for the transmitting and receiving of data and files used to interact with and manage the intranet site.

Email

Two of the business' sites use email as a primary application. Commonly, email applications such as Microsoft Outlook involve a client-based architecture. With this model, the client will manage all of the applications logic and presentation. As an email application does not require a lot of computational power, there is a higher return on investment for the client's machine to manage this logic. An email application will not need to scale beyond its relatively simple functionality of the viewing, writing, sending, and receiving of emails. Moving this computation to a server would be a waste of IT resources and money. Commonly, emails are sent using the SMTP transport layer protocol, and is what should be used for this type of application as it is the networking standard for email communication.

IP Telephony

The business' final site uses IP telephony as the primary application. As voice data is a stream, it must be of a high quality to ensure strong communication between the two parties calling. IP telephony involves the transmission and receivership of a stream of data at the same time and most commonly uses a Voice over IP (VoIP) transport layer protocol to communicate the streams of audio data. Again, a client-based architecture is best used here. Client-based architecture is best used for simple applications, of which the sending and receiving of a bit stream, and the encoding and decoding of that stream into audio data is quite straight

forward and does not require a high level of computational resources. Also, this architecture has increased security, as the data is not passing by and potentially being listened to or recorded by a middleman server.

However, as the business requirements change, for example, as the requirement of a customer call centre is implemented, a business might look towards a client-server architecture. The client will still be performing the same duties; however the server can be used to perform activities such as record calls for quality assurance and training purposes.

VLAN Backbone Networking

Backbone networks are used to connect the many LANs of a business, allowing for segmentation of the network based on the business' requirements and logical functions. Separating LANs is useful as it improves the management, efficiency, and scalability of the broader LAN. VLANs further improve the benefits of this segmentation by creating separation through software rather than through physical hardware. This drastically decreases complexity, improves flexibility, and ultimately, within reason, removes the physical location boundaries. This takes the management and flexibility of a network to the next level, allowing companies to meticulously create LANs designed around requirements.

Number of VLANs

As a VLAN is defined through software, the number and capacity of a VLAN can be decided based on the business' requirements. When looking at the information provided by the business, we can quickly identify the large number of employees and their separation by site. An effective method for determining the number and size of VLANs can be based around the number of departments, the number of business applications, the application access each department should have, and the expected level of traffic. If we were to make assumptions around the number of departments, of which there could be a total of 6. Marketing, sales, finance, administration, HR, and general logistics operations. Given that the ISP has provided a network address with a netmask of 25, there are a total of 7 host bits that can be used to create the companies required network. This means that there are a total of 128 hosts, of which only 126 are usable. Given that this business has listed a total of 9 applications, 1 of which is authentication, and which could have its own VLAN for each site, and an assumed total of 6 departments, we could create a total of 18 VLANs. These VLANs can be distributed so that there is 1 for each department, 1 for each application, and 4 for the authentication application, 1 for each site. The size of the VLAN can be determined by the expected traffic of the VLAN and should be calculated and considered before creating an arbitrary number.

Potential Infrastructure Changes

VLANs are commonly configured, managed, and orchestrate traffic using switches. Switches are inexpensive and very commonly used within an organisation, especially an organisation with nearly 5000 employees. It is safe to assume that the business will already have most of the infrastructure required to implement a VLAN backbone network. However, to connect sites, commonly a smart switch will be used at each site connected by a WAN trunk. This will enable the connection of the many LANs of the business which span over multiple sites and buildings. The smart switch is something that the business might not already have, and this cost should be considered.

Subnetting

The network can be subnetted to allow for simpler network management and create network segmentation. As this is the purpose of a VLAN, which has a near identical outcome, is software defined, has more flexibility, scalability, security, and is more manageable, subnetting is not required. As we previously discussed, the total number of usable hosts provided by the ISP is only 126, and the company has over 4000 employees, and most likely many more network devices, subnetting the small number will not have as many benefits. A complex LAN, NAT, and private network trafficking solution will need to be included to enable the networking of more than the 126 usable hosts, of which VLAN will be more effective at given all of the previous benefits. Subnetting is not critical for this business if they choose to implement a VLAN solution.

Data-Link Technology

As a company's network scales in size and complexity, it is paramount that an appropriate data-link technology is chosen to facilitate the challenges caused by this growth. By far the most common data-link technology used is Ethernet. Ethernet technology is capable of very high bandwidths, servicing nearly all companies of varying sizes and network requirements. Other data-link technologies used today include Token Ring and Fibre Channel, which have their own benefits and drawbacks in certain situations, but Ethernet will be the best technology of choice for this business.

Ethernet operates at the 2nd layer of the OSI model, managing the flow of traffic through from one device to the next. Commonly, end devices such as PCs, laptops, and VoIP phones will use Ethernet, making the design of the network simpler, and increases the business' number of choices of products. As Ethernet is so common in today's world, the cost of Ethernet is much lower than many of the competing data-link technologies, meaning that the business will have a higher return on the quality of their network for every dollar spent. Also, as Ethernet has already been widely adopted, the variety of quality, speed, bandwidth, and cost of Ethernet products such as an Ethernet switch is much higher than any other data-link technology, meaning that the business will be able to find a solution that better fits their requirements. VLANs are very commonly implemented using an Ethernet switching technology, and if the business is looking to move to a software defined VLAN backbone networking solution, Ethernet is an excellent choice to facilitate that migration. Finally, due to its abundance and simplicity, designing the network will be much simpler in comparison to other technologies. Therefore, the finding of high-quality talent with skills in the management, configuration, and designing of an Ethernet based network will be much easier to achieve, ultimately causing better outcomes for the business.

Due to Ethernet's widespread adoption at a global scale, its low cost, high bandwidth capabilities, the numerous choices of Ethernet technology solutions, and the high level of existing talent capable of designing, configuring, and managing the network, Ethernet is the best data-link technology solution that fits the business' requirements.

WAN

A wide area network (WAN) is commonly used to connect backbone networks together at great distances. A virtual private network (VPN) enables secure network communication over a standard internet connection, allowing the many sites of the business to transmit and receive data securely. VPNs are a very simple, easy to manage, and very cost-effective WAN solution. As a VPN can operate over any type of internet connection, the business has a range of choices as to what technology is used to connect each site to the internet.

Given that the business uses a VPN as the WAN solution, the business operational requirements, technical requirements, and the best value for money should be the key consideration in the decision of which access technology to choose. Therefore, the client should consider the implementation of the Fibre access technology. This is one of the newest technologies which uses a direct cable to connect the site to the internet. It has high reliability, high bandwidth speeds, and is often offered at competitive and affordable prices when compared to other similar technologies.

Given that the business has a very large number of employees, and a site that has IP telephony as a primary application, high bandwidth and low latency should ensure that the business is able to achieve their business requirements with a high level of efficiency and maximise their networks performance. In particular, when considering the medium sized IP telephony site, weak networking bandwidth will cause a high bottleneck for the employees, causing a large inefficiency. Finally, when comparing a cable connection technology such as Fibre to a wireless technology such as satellite, wave collisions can occur, increasing networking inefficiencies, slower speeds, and interruptions to business operations. All of these requirements must be considered when choosing an access technology, and when analysing the assumed business requirements, Fibre is the most appropriate choice.