



职业训练局
高可用性的信息技术基建
**High Availability IT
Infrastructure in VTC**

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职业训练局

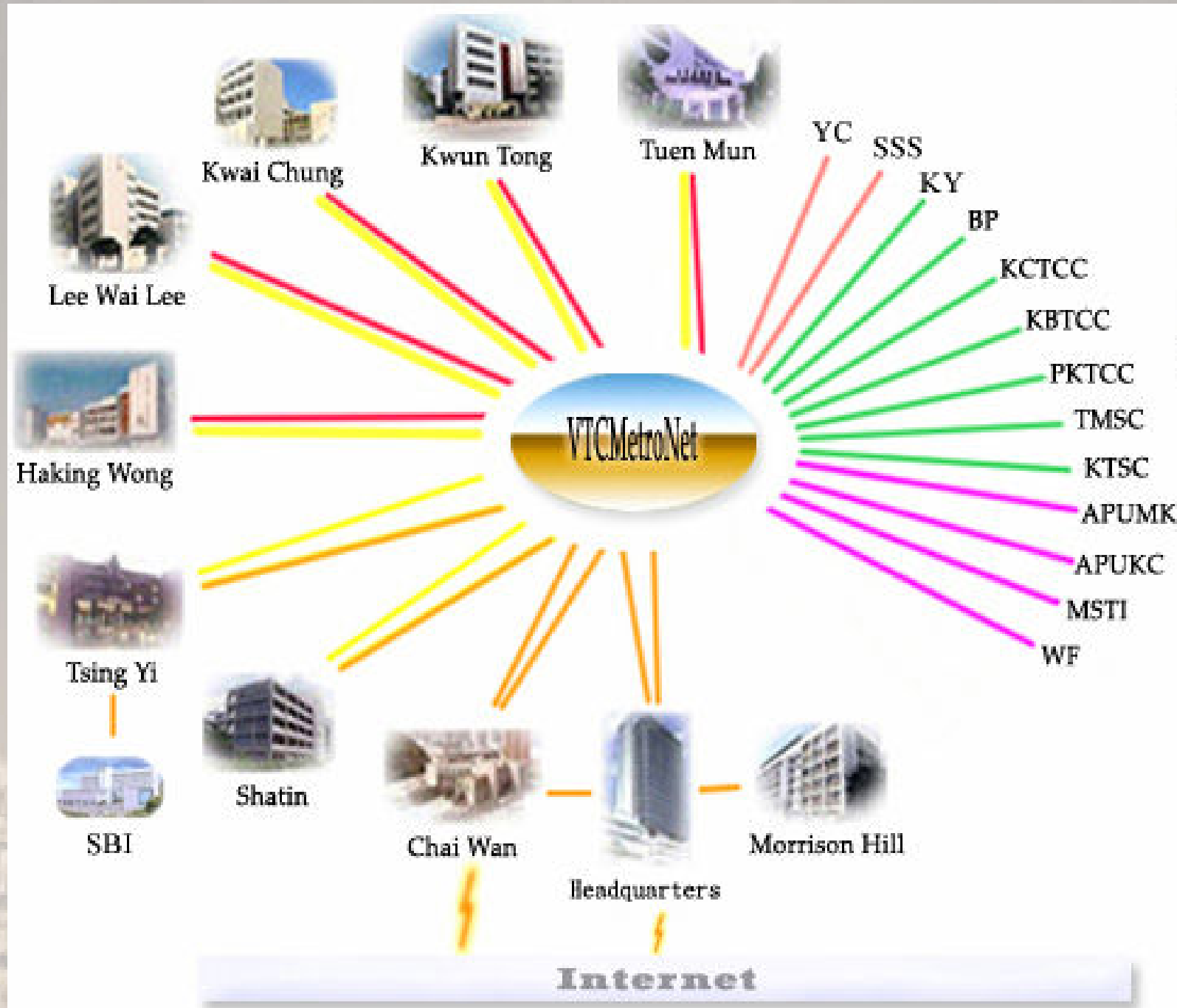
Vocational Training Council (VTC)

- Founded in 1982
- Provides job-related training and education to 160,000 people every year
- Thru
 - 9 Hong Kong Institute of Vocational Education
 - 1 VTC School of Business and Information Systems
 - 18 Training/Development Centres
 - 3 Skills Centres
- 成立于1982年
- 每年为十六万市民提供职业教育培训
- 包括
 - 九间香港专业教育学院
 - 工商信息学院
 - 十八间训练及培训中心
 - 三间技能训练中心

Legend

WAN	
	100M
	50M
	20M
	10M
	5M
	2M

* VTCMetroNet is connected by HGC



高可用性

High Availability

- Traditional terms
 - Disaster Recovery
 - Hot/Cold Standby
 - Redundant Network
- Newer terms
 - Business Continuity Plan (BCP)
 - Load Balancing (Active/Active)
 - High Availability
- 传统术语
 - 灾后恢复
 - 热/冷备份
 - 冗余网络
- 新的术语
 - 营运持续计划
 - 负载均衡 (主动/主动式)
 - 高可用性

灾难回复

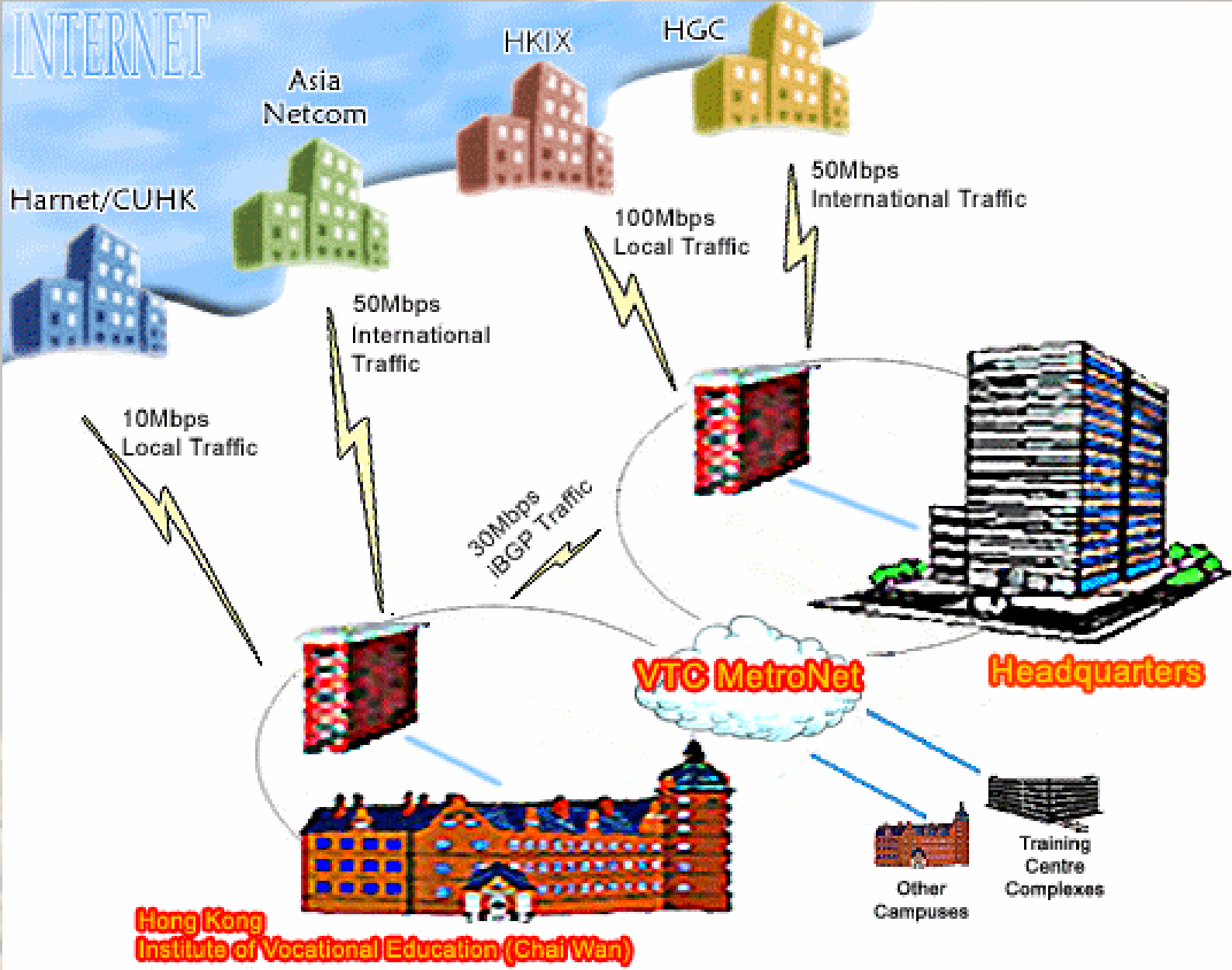
Disaster Recovery

- Standard Dual Site Network
 - Headquarters and Chai Wan
 - Dual Internet link
 - Internal link joining two sites
- 一般拥有双重地址的网络
 - 总部及柴湾分校
 - 两组互联网的联机
 - 一组联机两个地址的内部联机

如何达成营运持续计划?

How to achieve BCP?

INTERNET



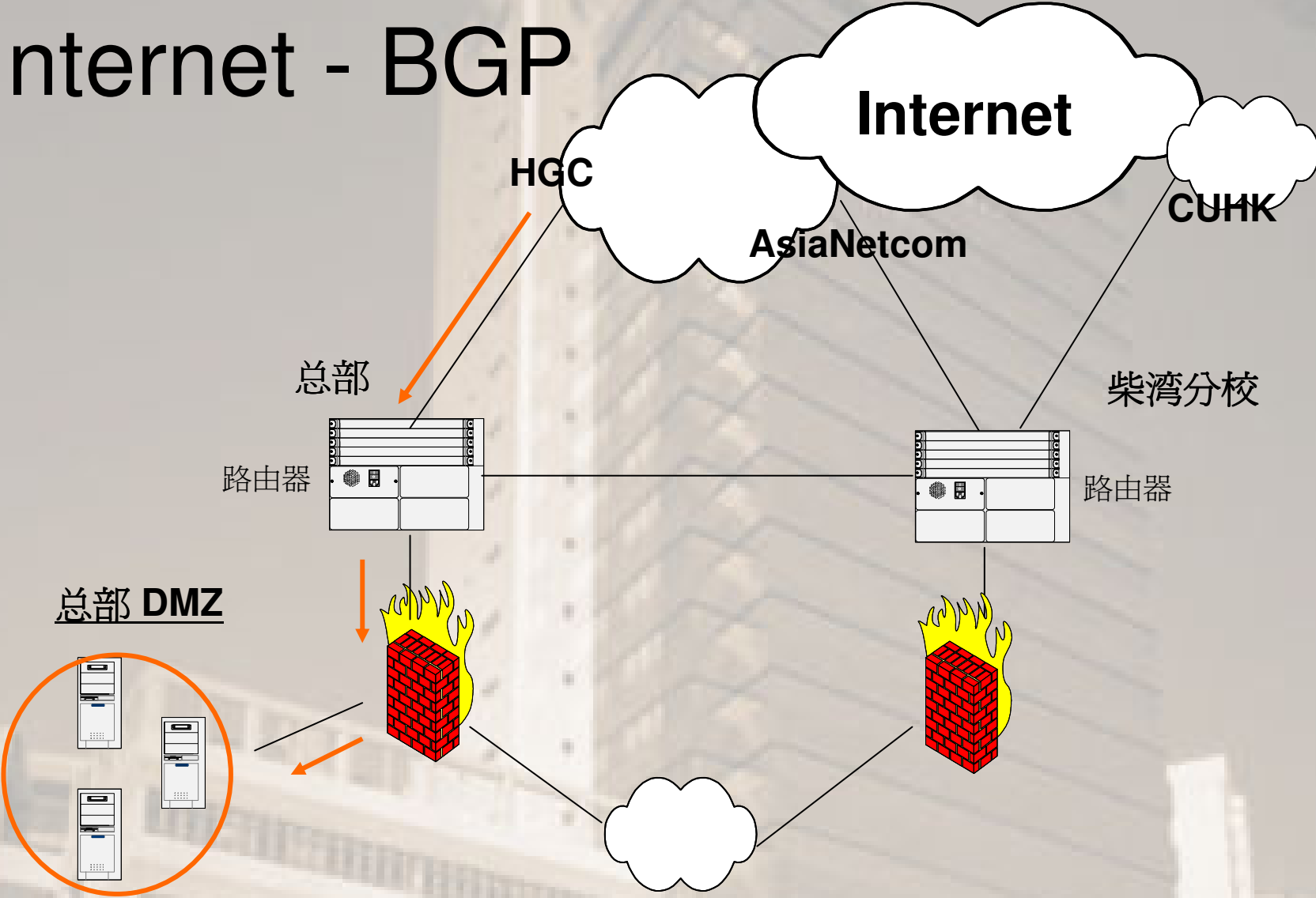
**Hong Kong
Institute of Vocational Education (Shai Wan)**

不只是计算机网络, 而且还有 ...

More than just network

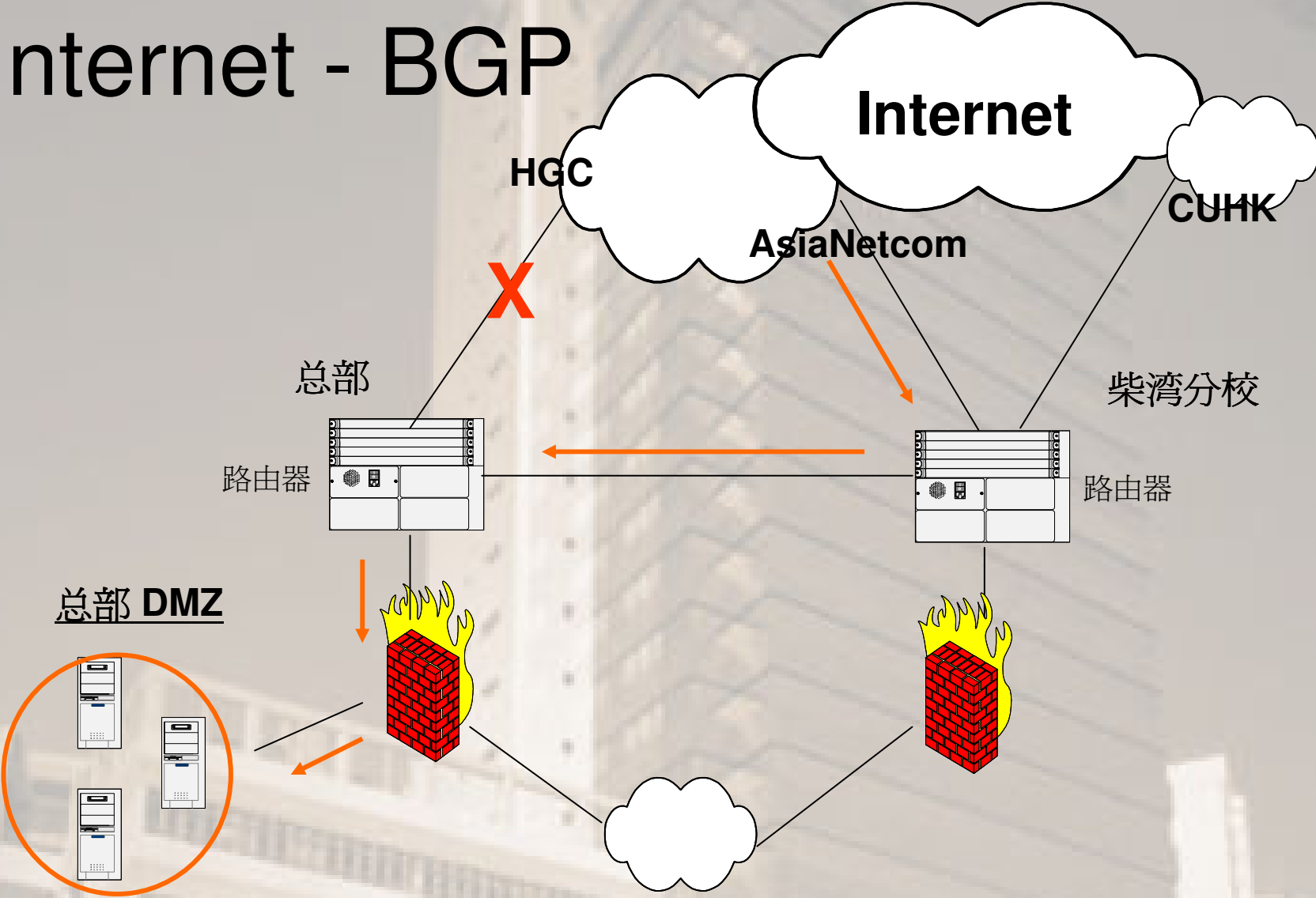
- IT infrastructure require more than just dual physical link
 - Multiple DNS
 - Active-Active LDAP
 - Load Balancing Anti-virus/spam gateway
 - Application load balancing/SSL acceleration switch
 - BGP / HSRP hot standby
- 信息技术的基建，不仅需要两条实质的联机，亦包括
 - 多重域名服务器
 - 主动-主动 LDAP 服务器
 - 防毒/垃圾邮件服务器的负载平衡
 - 应用系统负载平衡/ SSL 促进交换器
 - BGP / HSRP 热备份

Internet - BGP



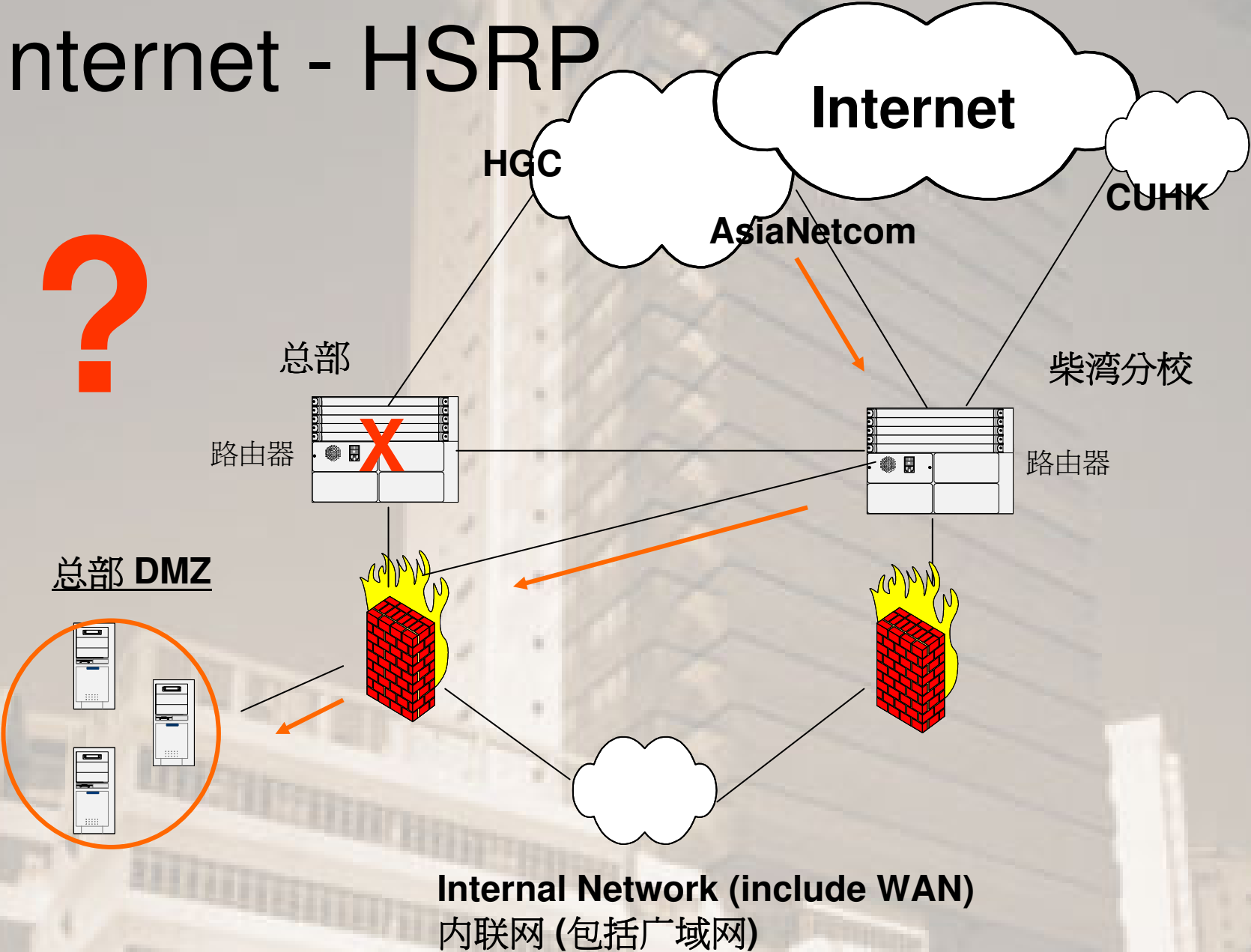
Internal Network (include WAN)
内联网 (包括广域网)

Internet - BGP



Internal Network (include WAN)
内联网 (包括广域网)

Internet - HSRP



Internal Network (include WAN)
内联网 (包括广域网)

负载均衡

Load Balancing

- Intelligent load balancing
 - Layer 7 - application load balancing switch
 - SSL acceleration
 - Intelligent DNS
- Application choose
 - hot standby (e-mail)
 - Active – Active (LDAP)
 - Cold standby
- 智能负载均衡
 - 针对第七层 - 应用程序的负载均衡交换器
 - SSL促进器
 - 智能域名服务器
- 多种应用模式可供选择
 - 热备份 (电子邮件)
 - 主动 – 主动 (LDAP)
 - 冷备份

服务器负载均衡

Server Load Balancing

Traditional DNS Load balancing

传统的域名服务负载均衡法

- 循环 (Round Robin)

```
C:\>nslookup www.vtc.edu.hk
Server: dns.vtc.edu.hk
Address: 202.40.209.220
```

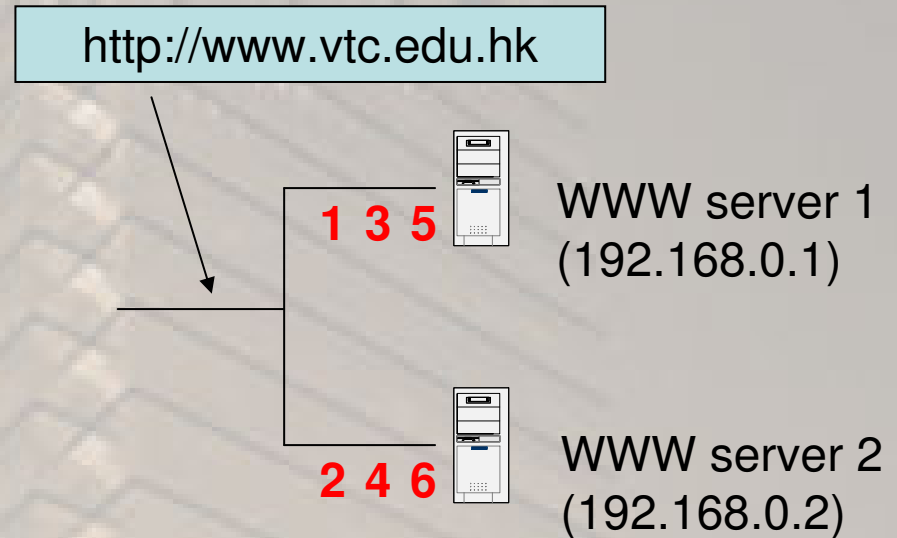
```
Non-authoritative answer:
Name: www.vtc.edu.hk
Addresses: 192.168.0.1, 192.168.0.2
```

缺点:

1. 未能留意到服务故障
2. 只支持 Round Robin 方法

Disadvantages:

1. Not aware service outage
2. Only support Round Robin method



Server Load Balancing

服务器负载均衡

- using BigIP

(Layer 7 load balancing switch)

- 使用BigIP

(针对第七层- 应用程序的负载均衡交换器)

```
C:\>nslookup www.vtc.edu.hk
```

```
Server: www.vtc.edu.hk
```

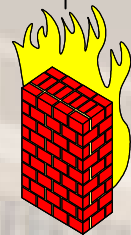
```
Address: 192.168.254.254
```

```
Name: www.vtc.edu.hk
```

```
Address: 192.168.0.3
```



Internet



BIGIP



VIP: 192.168.0.3



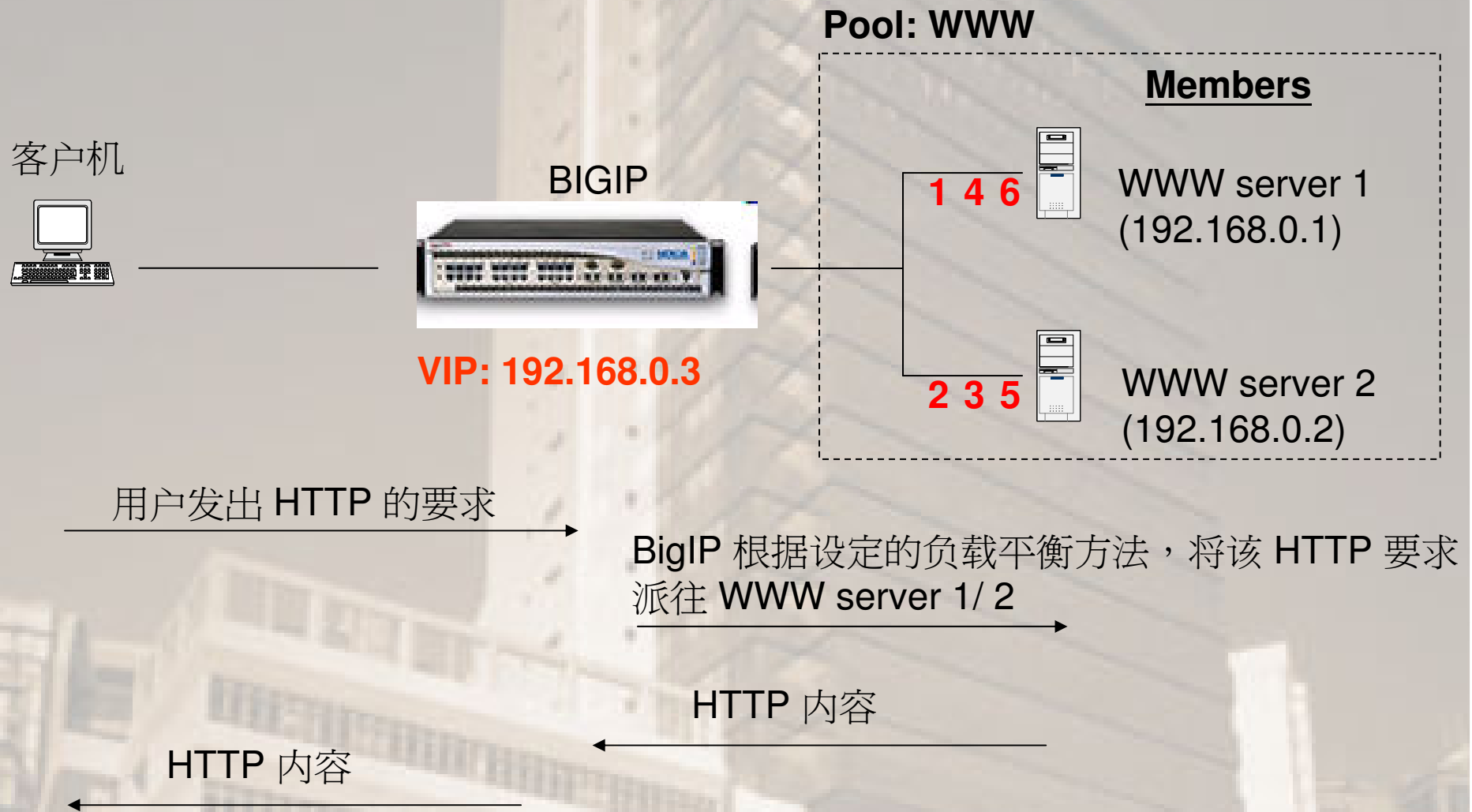
WWW server 1
(192.168.0.1)



WWW server 2
(192.168.0.2)

服务器负载均衡 - BigIP

Server Load Balancing – BigIP



服务器负载均衡 - BigIP

Server Load Balancing – BigIP

- Monitoring by Services, e.g http, ftp, tcp-443
 - Load-balancing methods:
 - Round Robin
 - Ratio / Dynamic Ratio
 - Least connections
 - Fallback host – pointed to a static URL in case all members are not available
- 以服务来监察, 例如 http, ftp, tcp-443
 - 负载均衡的方法:
 - Round Robin
 - Ratio / Dynamic Ratio
 - Least connections
 - Fallback host – 当所有服务器成员都不能提供服务时, 指向一个特定的网址

BigIP - 持续性

BigIP – Persistence

- For ebanking, secure session ...
 - in our case, report generation
 - Persistence methods:
 - Simple persistence, HTTP cookie persistence, SSL persistence
 - Simple persistence
 - record the client IP address and expire the persistence by timeout setting
 - Timeout vs Load balance
- 为了使用电子银行, 安全性的持续期间...
 - 我们在「产生报告」时需要设定持续性
 - 设定持续性的方法:
 - Simple persistence, HTTP cookie persistence, SSL persistence
 - Simple persistence
 - 以客户机的 IP 地址为记, 有效期以“超时设定值”为根据
 - 超时设定对负载平衡的影响

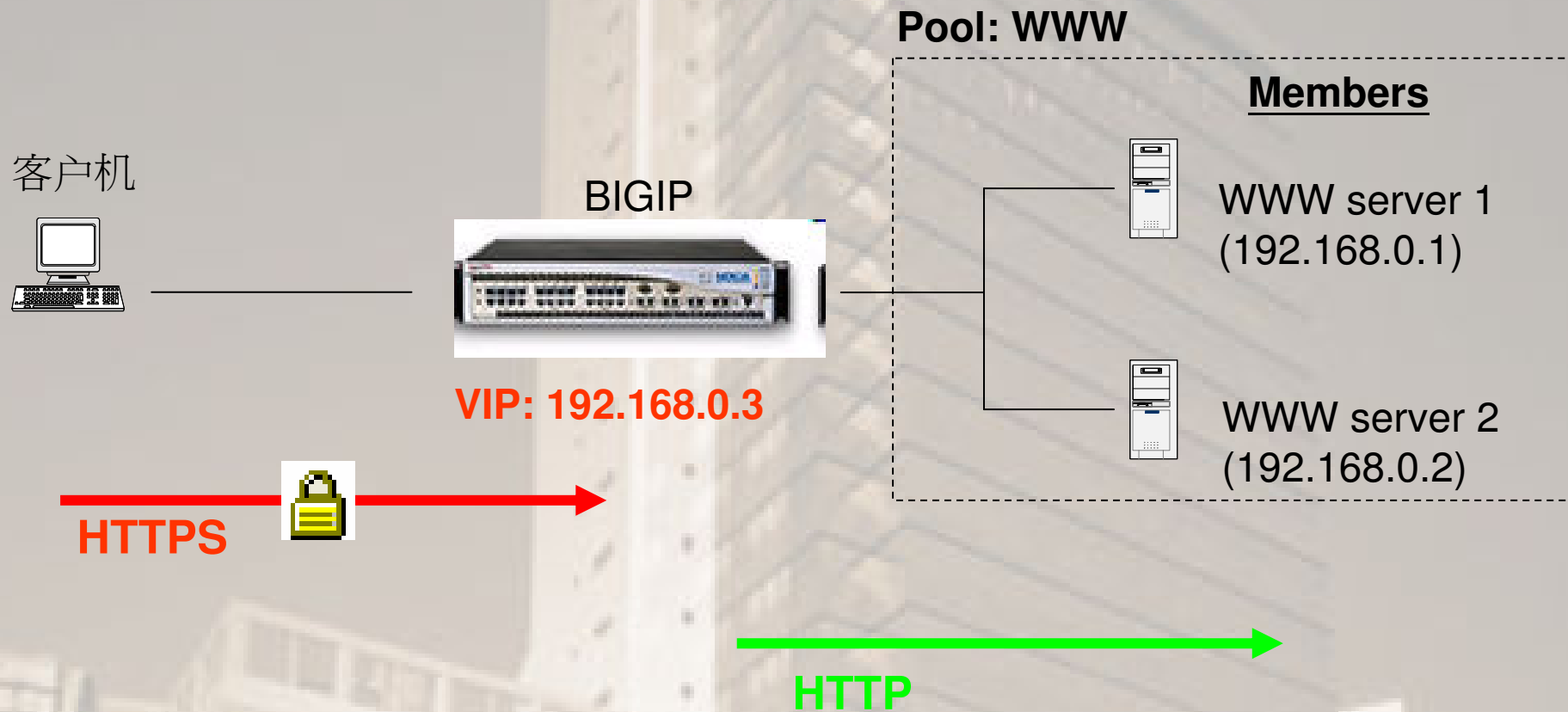
SSL 促进器

SSL Acceleration

- SSL connection terminated on BigIP instead of original servers
- Ecert is only required to install on BigIP
- No SSL overhead on resource of original servers
- Original servers have nothing to change
- SSL 连接上 BigIP ，而非在原有的服务器上
- 电子证书只需安装在 BigIP
- 在原来的服务器上，没有任何与 SSL 有关的资源需求
- 原来的服务器不需要作出任何改变

SSL 促进器

SSL Acceleration



SSL 促进器

SSL Acceleration

- 有何不同? Any difference?

1. ...<A href=“<http://www.vtc.edu.hk/image/a.gif>”>
...
Hard coded
2. ...<A href=“</image/a.gif>”> ...

必须要使用第二种方式
MUST use method 2 !



达致高可用度
**Achieving High
Availability**

广域地址的负载平衡

Global Site Load-balancing

总部



WWW server 1 (192.168.0.1)

WWW server 2(192.168.0.2)

使用 3DNS !!
Use 3DNS !!

分校



WWW server 3 (192.168.1.1)

广域地址的负载平衡

Global Site Load-balancing



Try to access :
<http://www.vtc.edu.hk>



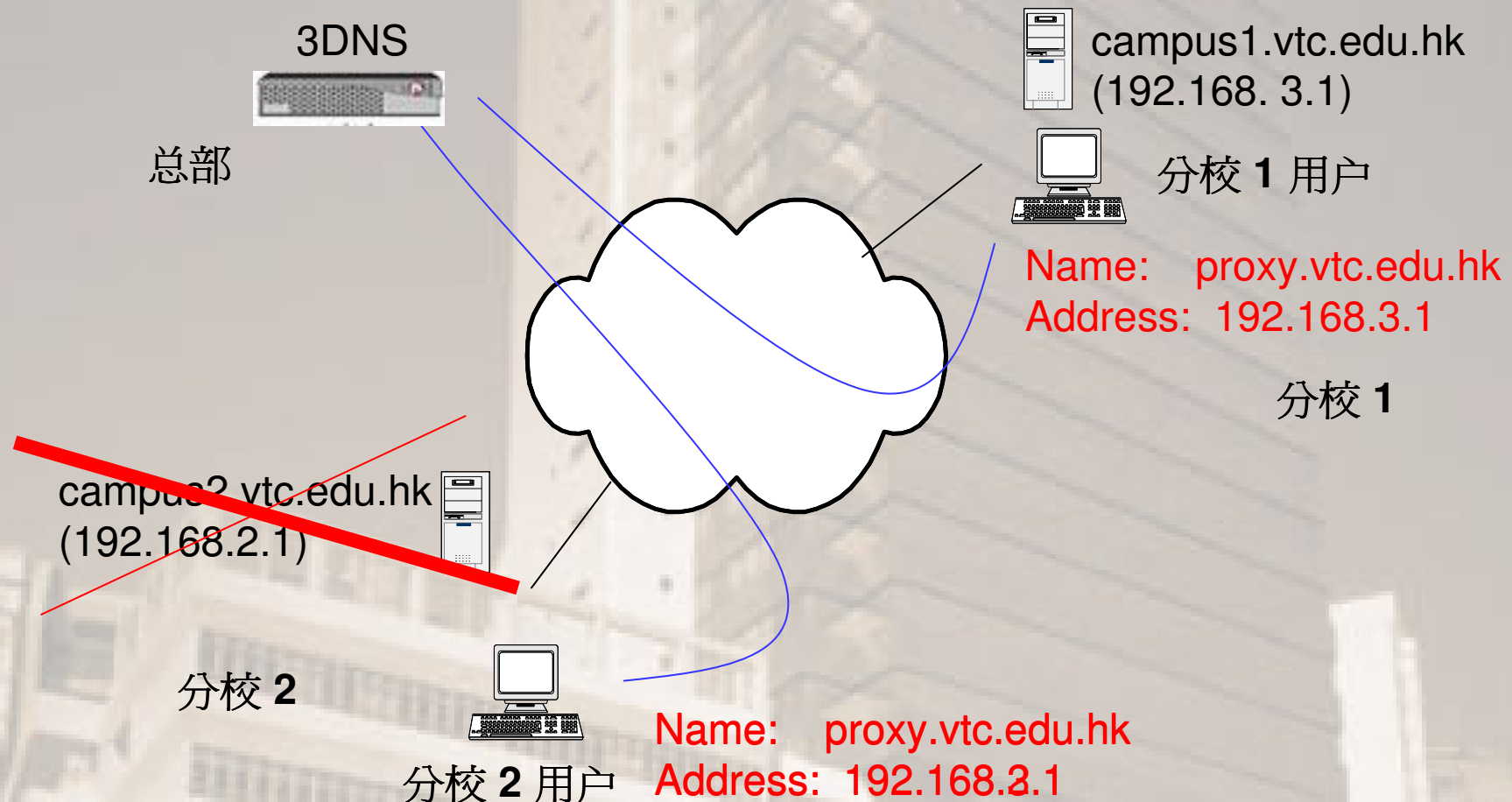
尝试存取
<http://www.vtc.edu.hk>

1. Resolve the IP address of “www.vtc.edu.hk”
2. Contact the DNS server
3. 3DNS know our network topology, tell user an IP address that is the best

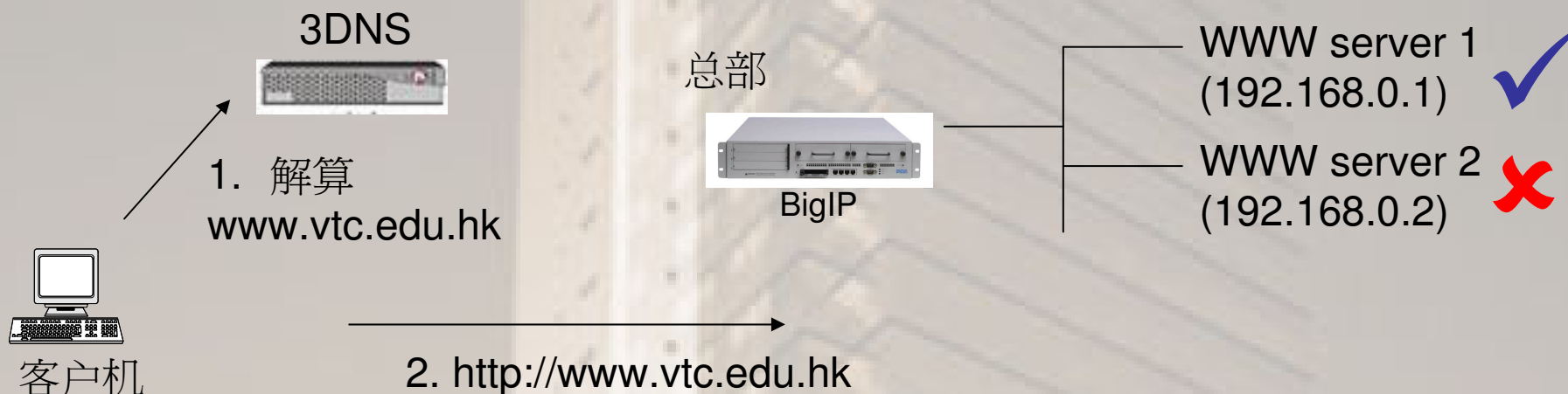
1. 将 “www.vtc.edu.hk” 的 IP 地址解算出来
2. 接触域名服务器
3. 因为 3DNS 知道我们的网络拓朴，所以它能够为客户提供最合适的 IP 地址

广域地址的负载均衡

Global Site Load-balancing



广域地址的负载均衡 Global Site Load-balancing Hot Standby 热备份



3DNS 使用下列方法
解算 IP 地址:

- 可用性
- 负载均衡的方法
(类似 **BigIP**)
- 拓朴
(类似 **Proxy** 服务器个案)

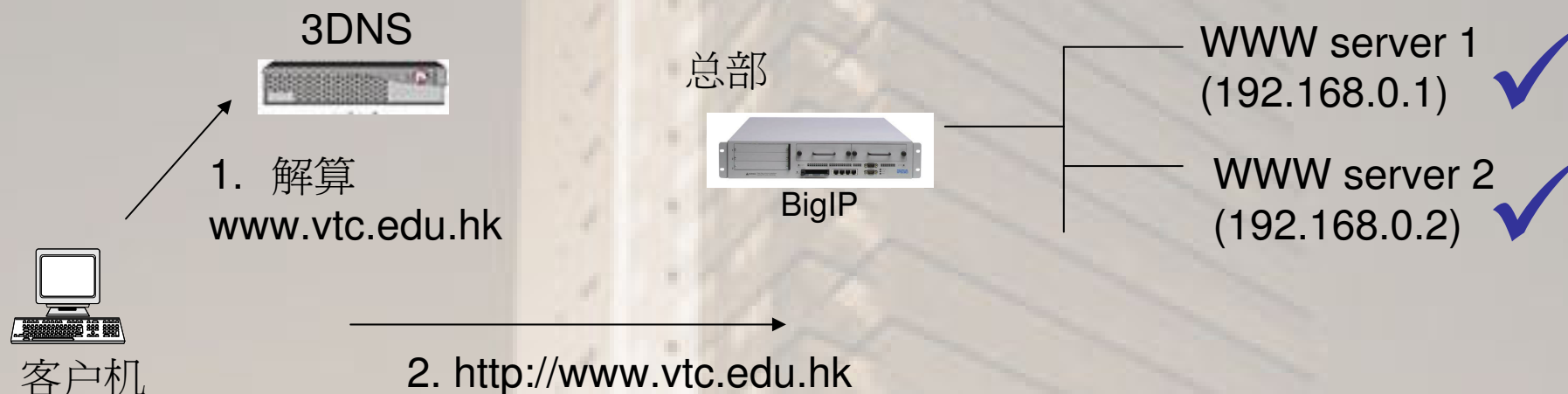
分校



广域地址的负载均衡

Global Site Load-balancing

Active - Active 主动 - 主动



3DNS 使用下列方法
解算 IP 地址:

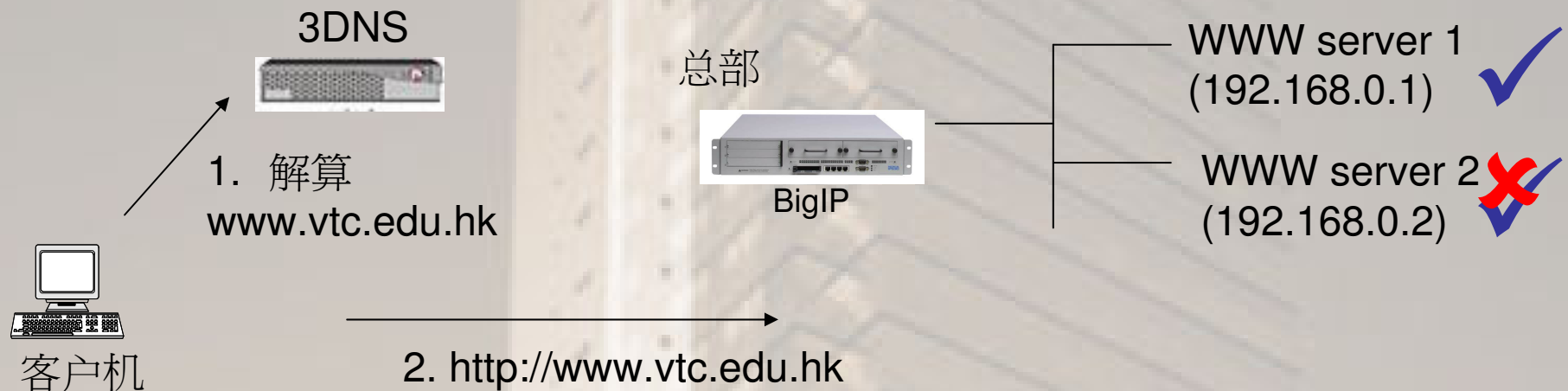
- 可用性
- 负载均衡的方法
(类似 **BigIP**)
- 拓朴
(类似 **Proxy** 服务器个案)

广域地址的负载均衡

Global Site Load-balancing

将服务器由总部迁往柴湾分校

Server migration from HQ to CW



3DNS 使用下列方法
解算 IP 地址:

- 可用性
- 负载均衡的方法
(类似 **BigIP**)
- 拓朴
(类似 **Proxy** 服务器个案)

分校



BigIP

WWW server 2
(192.168.1.1) ✓

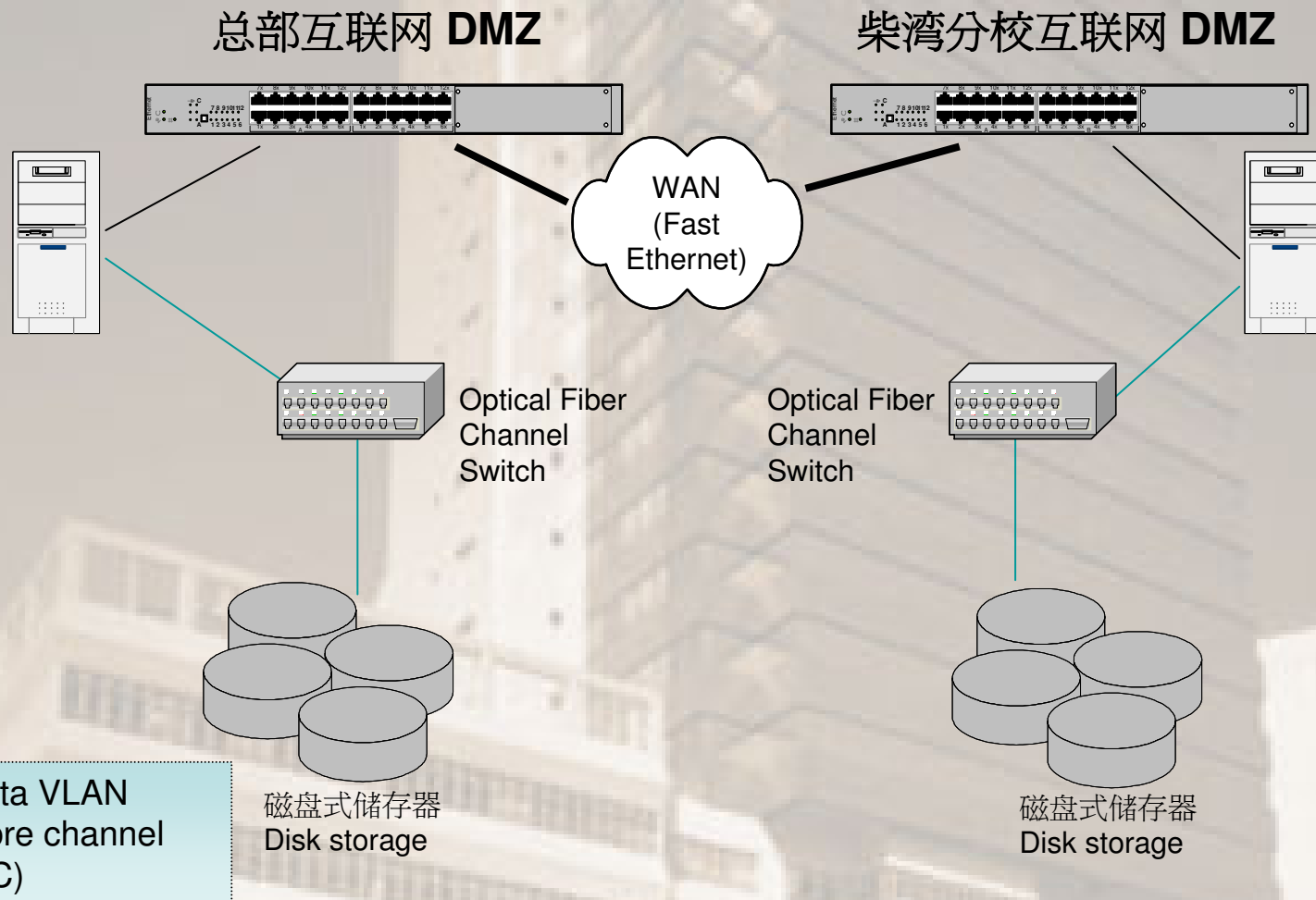
构思中的计划

In the pipeline

- Remote SAN
 - Using Optical Network
 - Support Long distance
 - Expensive
 - Using IP
 - Longer delay / Performance problem
 - Security
- 远程 SAN
 - 使用光纤网络
 - 支持长距离
 - 昂贵
 - 使用 IP
 - 较长的延滞 / 效能问题
 - 安全问题

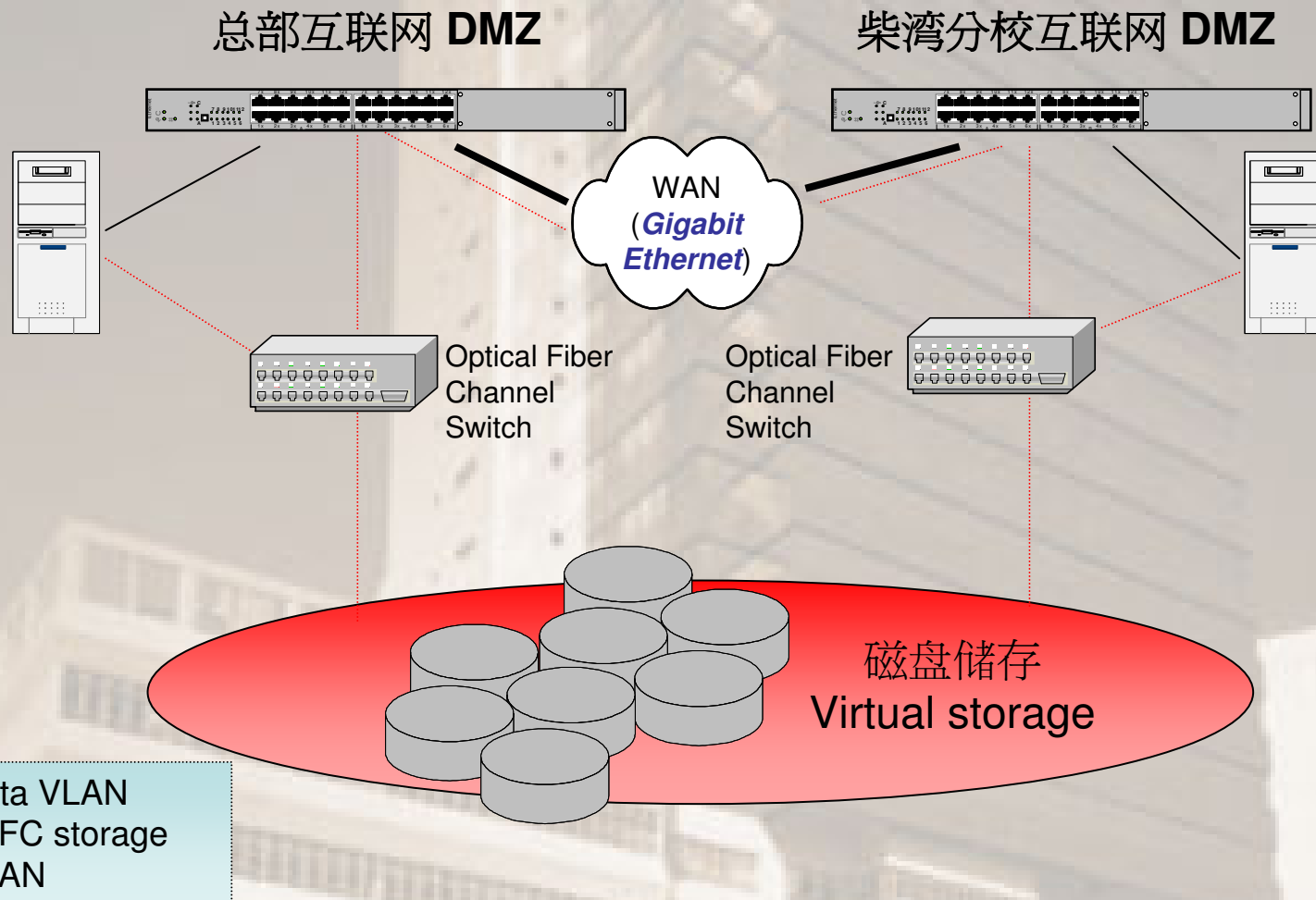
虚拟化磁盘

Disk virtualization



虚拟化磁盘

Disk virtualization



高可用度及营运持续计划的总结

High Availability / BCP Summary

- A redundant network infrastructure
- Ability to offer Global load balancing/SSL
- Updated data at the remote site
- A detail Business Continue Plan
- Test, drill and review the plan regularly
- 冗余网络的基建
- 能够提供广域地址的负载平衡/SSL
- 更新在离站的数据
- 一份详细的营运持续计划
- 定期测试, 演习及回顾该计划

计划中需要考虑的细节

Planning Considerations

- Additional Hardware Cost
 - Disk
 - Server
 - Network/FC card/ports
- Additional Software License
- Technically complex
- Most Importantly is **Management/Operation Cost**
- 额外硬件成本
 - 磁盘
 - 服务器
 - 网络/光纤管道卡/端口
- 额外软件成本
- 复杂的技术
- 更重要的是管理/操作成本



问答时间 **Question & Answer**



感谢!
Thank You!