The Akamai Network

A Platform for High-Performance Internet Applications

Edvard Bakken
Akamai - introduction

- 61 000 servers across 70 countries
- Current internet architecture does not meet current needs
  - Many bottlenecks
- Akamai built a CDN to overcome this
  - Handled 15-20% of internet traffic in 2010
Poor service has consequences

● Reduced performance impacts business
  ○ One hour of outage - $2.8 million in lost sales (2009)
  ○ What about today?

● Reputation is a factor

● 40% of users will find a new service if loading exceeds 3 seconds
Internet does not meet these requirements

- Best-effort, no guarantees
- Latency, packet loss, outages, inefficient protocols
- Online video needs even more
Bottlenecks on the internet

- Internet is many networks that are connected
  - Largest network only handles about 5% of total traffic
  - Content visits multiple networks to reach end users

- Peering point congestion
- Inefficient routing
- Unreliable networks
- Inefficient communication
- Scalability
- Application limitations and slow rate of change adoption
Content Delivery Network

- Brings static content closer to end users
- Avoids bottlenecks
- Provides management tools, logging etc.
- Virtual network as software layer over the Internet
- Enhanced scalability, security, reliability and performance

Figure 2: A delivery network is a virtual network built as a software layer over the Internet that is deployed on widely distributed hardware.
Figure 3: System components of a delivery network. To understand how these components interact, it is instructive to walk through a simple example of a user attempting to download a web page through the Akamai network.
System design principles

- **Reliability**
  - Expect failures
  - Ensure redundancy

- **Scalability**
  - Handle increasing traffic
  - Handle increasing amounts of data

- **Limit need for human management**
  - Operate in spite of failures
  - Self-tune

- **Performance**
  - Improve end user experience, cache hit rates etc.
  - Reduce energy usage
Performance and scalability

- Location, location, location
  - As close to the user as possible
- Many smaller clusters
- Increases availability
- Increases throughput
Transport system

- Moves content from origin to edge server
- Tiered distribution
  - Parent clusters act as intermediary caches
  - Reduces requests to origin by more than 90%
- Overlay network for live streaming
  - Spread content to entry points
  - Publish/subscribe between entry points and edge servers
  - Reflectors help make transfers more efficient
Application delivery networks

- Improves performance of dynamic applications
- Transport system can be used to avoid bottlenecks
- Logic can be moved to edge servers
Transport system for applications

- Communication between any two Akamai servers can avoid all bottlenecks
- Helps both upload and download, relies on the large amount of smaller clusters around the world.
- Path optimization
  - Use data from Akamai mapping system to chart a path to origin
- Packet loss reduction
  - Use paths found previously for redundancy
- Transport protocol optimizations
  - Proprietary protocols allow for more aggressive tuning, due to more reliable network
- Application optimizations
  - Prefetch or compress content
Hosting applications at the edge

- Akamai provides cloud computing close to the users
  - Several technical challenges
  - Difficult for apps that rely heavily on transactional databases
- Many useful use cases
  - Content aggregation
  - Static databases
  - Data collection and forms
  - Front end at the edge
Figure 5: System components of the Akamai platform.
Edge server platform

- Handles requests from users
- Many tweaks and features
  - Cache control
  - Cache indexing
  - Access control
  - Response to origin server failure
  - Header alteration
  - EdgeComputing
  - Performance optimization
Mapping system

- Directs traffic
- Scoring
  - Capture connectivity across the internet
- Real-time mapping
  - Use scoring to create actual maps
  - Assigns end users to edge servers
    - Map to cluster
    - Map to server
  - Assigns parent clusters and intermediaries
Communications and Control system

- Handles communication between Akamai machines
- Dynamic config or software updates and management
Data collection and analysis

- Over 100TB of logs per day
- Monitoring
- Analytics
- Billing
Additional systems

- DNS
- Monitoring agents
- Global traffic manager
- Storage
- Client side delivery
- Management portal
Section 8 & 9

- Examples and customer cases
- They seem to provide great results