

Internet Engineering

241-461

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Contents

- ◊ The Domain Name System
- ◊ The DNS Database
- ◊ DNS Protocols
- ◊ DNS Message Formats
- ◊ DNS Limits
- ◊ Zone Transfer
- ◊ Mapping Addresses to Names

Zone Transfer

- ◊ Used by Secondary Server
 - to update its copy of zone file
- ◊ SOA Resource Record drives zone transfers

```
psu.ac.th. 12H IN SOA (
ns.psu.ac.th. netadmin.ratree.psu.ac.th.
2001080801 ; serial
10800 ; refresh - 3 hours
1200 ; retry - 20 minutes
1209600 ; expiry - 2 weeks
43200 ) ; minimum - 12 hours
```

- ◊ Serial number
 - defines whether zone is up to date

Zone Transfer (2)

- ◇ Secondary uses SOA.serial
 - compare with primary
- ◇ If older (smaller)
 - do AXFR query
 - fetch updated copy of zone
- ◇ Serial numbers cycle
 - 0, 1, 2, ..., $2^{32}-1$, 0, 1, 2, ...
- ◇ Zones generally larger than 512 bytes
 - so AXFR uses TCP
- ◇ SOA parameters guide secondary
 - refresh - how often to poll primary
 - retry - how often to retry if refresh fails
 - expiry - how long to serve zone data
 - ▷ if unable to refresh

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Mapping Addresses to Names

- ◇ DNS Inverse Query (Opcode == 1)
 - Client gives the answer
 - Server fills in the Question
- ◇ Which server???
 - The server that knows the answer...
 - But must ask the question to find that server
 - ▷ or potentially ask every server
- ◇ Not a rational approach!

Mapping Addresses to Names (2)

- ◇ Treat address as a key in the database
- ◇ Do a normal Lookup
 - (for an RR type that contains a domain name as data)
- ◇ For IPv4
 - Address 1.2.3.4
 - Lookup 4.3.2.1.IN-ADDR.ARPA
 - Look for PTR type
- ◇ PTR is simply a DNS type
 - that contains a pointer to another place in the DNS tree
 - ie: contains a domain name
- ◇ For IPv6
 - Similar, but with much longer names
 - IP6.INT or IP6.ARPA

User Datagram Protocol

- ◇ Transport Protocol
 - Requires Transport Addressing
 - Like TCP
 - Unreliable
 - No loss recovery
 - No sequencing (ordering)
 - No duplicate suppression
 - Error detection
 - Optional
- ◇ Transactional
 - Unit data transfer
 - Compare TCP
 - Data stream
 - No boundaries

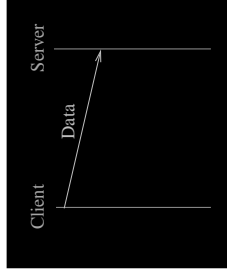
UDP

- ◇ Requirements
 - Addresses
 - Packet error detection
 - Access to Network Layer
- ◇ Addresses
 - Same as TCP
 - Network Address
 - Port
 - Port same as TCP in style
 - Independent number spaceTCP port 8080 ~ UDP port 580
- ◇ Error detection
 - Checksum
- ◇ That's it!

UDP Datagrams

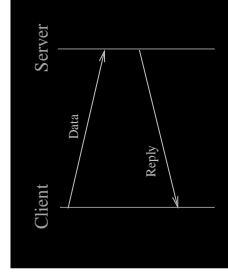
- ◊ Datagram
 - Name for PDU
 - Protocol Data Unit
- ◊ Compare TCP
 - Data stream
 - Beginning
 - Multiple segments
 - .. very many
 - Ending
- ◊ UDP
 - Single, indivisible, data block
 - Restricted size
 - 64KB (65535) maximum
 - (max. packet size)
 - Datagram
 - Like telegram
 - or SMS

UDP Operation



UDP Operation

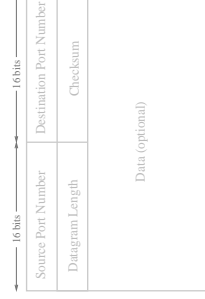
- ◊ Single datagram
 - From one system to another
- ◊ That's it
 - ... for UDP



UDP Operation

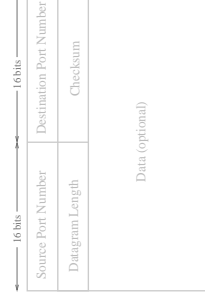
- ◇ Single datagram
 - From one system to another
- ◇ That's it
 - ... for UDP
- ◇ Typical Application
 - Eg: DNS
- ◇ Request
 - Client -> Server
- ◇ Reply
 - Server -> Client
- ◇ No error recovery
 - Application task

UDP Datagram Format



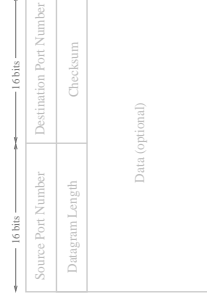
- ◇ Source Port
 - Just like TCP
- ◇ Destination Port
 - Transport Addressing
 - ▷ Identifies Application
 - Sending Application
 - Receiving Application
 - Values 0 .. 65535
 - ▷ Separate Number Space from TCP

UDP Datagram Format (2)



- ◇ Datagram Length
 - Count (octets / bytes)
 - ▷ Length of UDP datagram
 - Header length (8) + Data Length
 - Minimum value 8
- Unnecessary information
 - ▷ No equivalent in TCP
 - ▷ Network Layer also supplies length

UDP Datagram Format (3)



- ◊ Checksum
 - Error Detection Mechanism
 - Algorithm Later
 - Same as TCP
 - Optional (in IPv4 only)
 - Some applications want data
 - Any data
 - Even incorrect data
 - Rather than nothing
 - Why IPv4 only when IPv6 examined later
- ◊ That's all of UDP!

Network Layer

- ◊ Requirements
 - Addressing
 - Packet transport
 - Between systems identified by addresses
 - With some kind of packet importance
 - Packet Lifetime
 - TCP requires old packets die
 - Not loop forever
 - So does network sanity!
 - Transport Protocol Identification
 - TCP or UDP or ...
 - Error Detection
 - Very limited error detection
 - Relates to packet delivery only
 - Packet Length
 - Link Layer Interface
 - Cope with many different link layers