Evaluation Method

- Interim and Final Report
- Attendance is not Checked, but, ...
- Questions or Comments are Mandated
  - In the quarter, questions or comments with technical content must be made at least twice during lecture (may be in Japanese)
  - Good questions and comments will be awarded with points
  - Declare your name and student ID, if you make questions or comments

Evaluation with Zoom

- questions/comments should be asked/made by oral interruption (not by chat)
  - raising hand by zoom is hard to be noticed unless dedicated chair is assigned
  - don't hesitate to interrupt my talk
    - questions/comments over chat is too easy
- name/ID and points are declared and given through chat
  - use private chat, if you don't want your ID publicly viewed

For Better Vocal Communication with Zoom

- echo cancellation of zoom is, seemingly, not very good
- it is strongly recommended to turn off speakers and use head/ear phones (should be available at 100-yen shops)

Advanced Lecture on Internet Applications

7. Text based Communication: Web, HTTP, HTML, JAVA Script

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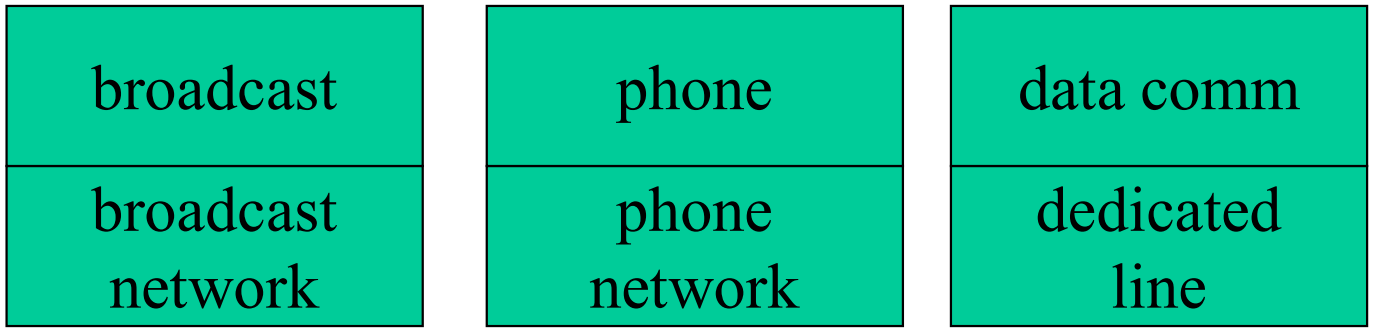
BTW, What is the Internet?

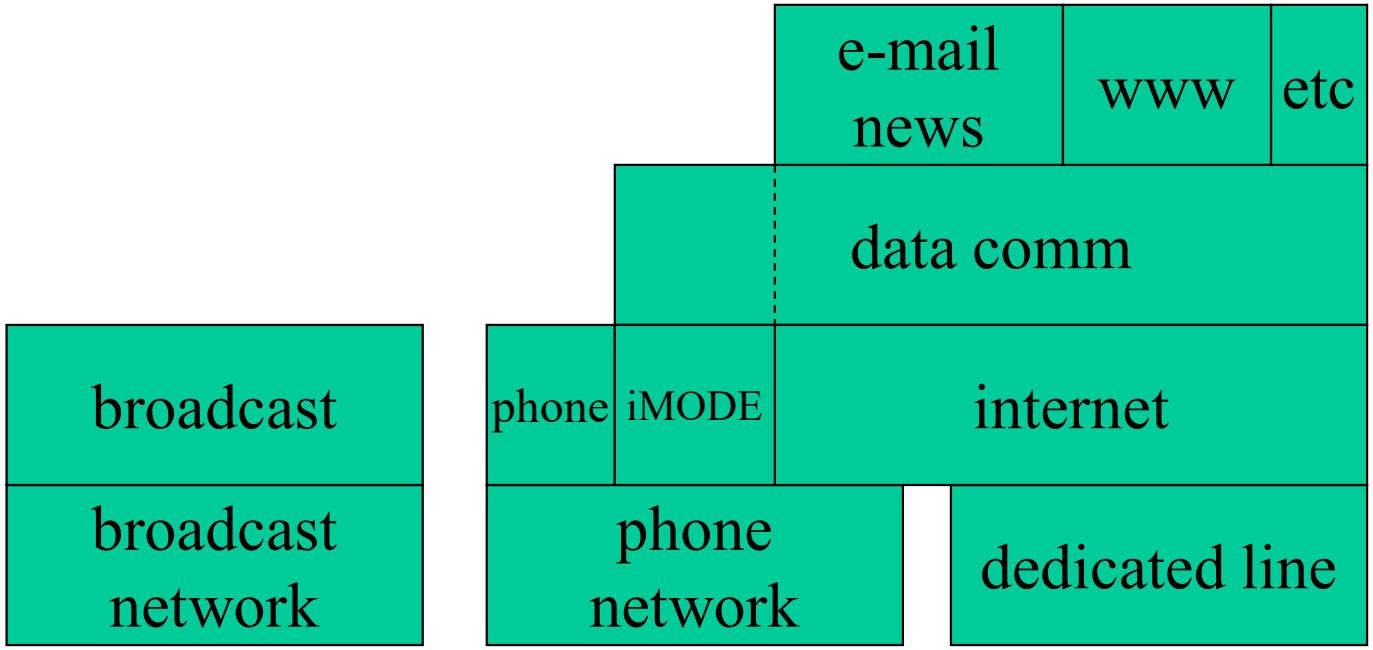
- Not e-mail
  - seriously thought so 20 years ago
- Not web, either
  - many still misunderstand so
- Is not applications
- The Internet is a network directly connecting terminals based on the principle of the Internet using IP (Internet Protocol)

Application?

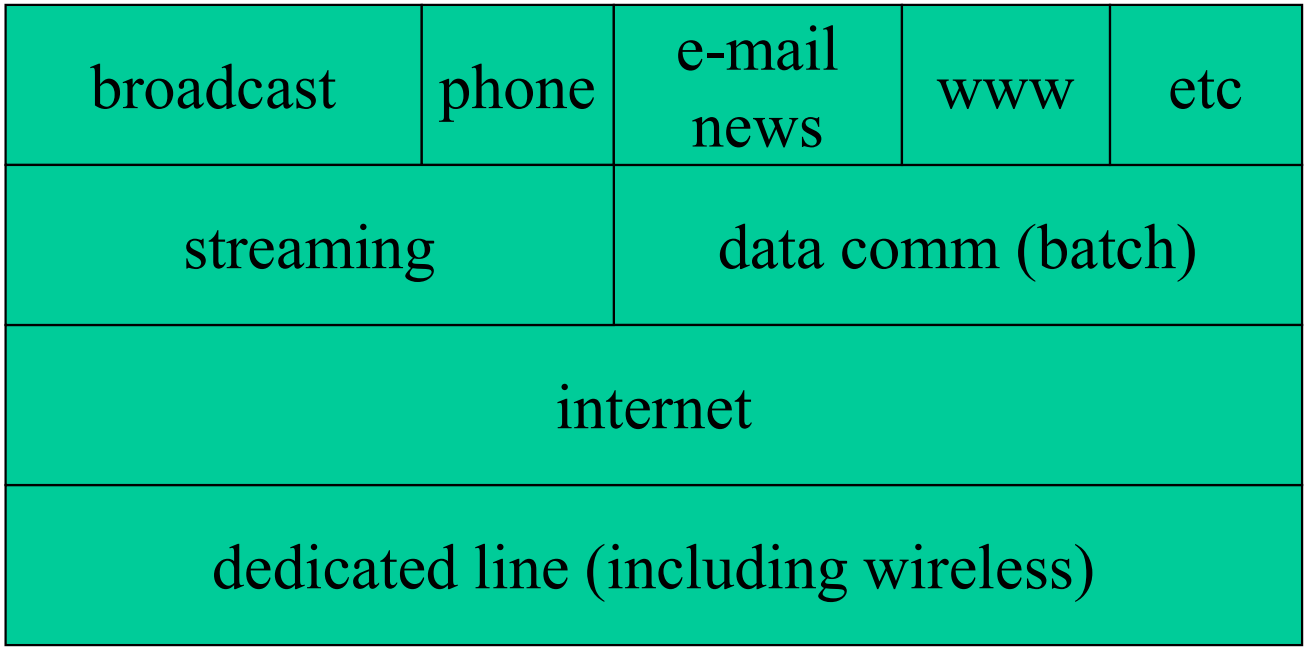
- face skin (important to be a beauty)
  - total revenue of official i-mode sites is about 4% of total revenue of Docomo
- “though US may invent web” (speech by a Swiss politician in INET @ Geneva)
- we need some application, but any application is OK



networks before the Internet



networks with the Internet



network in the future

History of Web

- a teletext system
  - NAPLPS (North America) and CAPTAIN (Japan) failed
  - MINITEL (around France) was successful
    - easy to provide servers, free terminals
- web is Internet version of MINITEL
- so successful because of the Internet and Moore's law
  - easy to provide servers, inexpensive terminals

HTML (HyperText Markup Language, rfc1866)

- hypertext
  - text with hyperlinks (URI) embedded
  - very old concept with more than 50 years of history
- mark up
  - formatting directives
    - such as indentations by string surrounded by “<” and “>”
  - originally European centric, though improving
    - vertical writing etc.

URI (Uniform Resource Identifier, rfc2396)

- URN (Uniform Resource Name)
  - identify resource without locating
  - a method to reference something
- URL (Uniform Resource Locator)
  - identify resource with location
    - if in the Internet, address of servers and port#
- can click and surf
  - because URLs are instantly used free of charge

Example of URLs

ftp://ftp.is.co.za/rfc/rfc1808.txt

-- ftp scheme for File Transfer Protocol services

gopher://spinaltap.micro.umn.edu/00/Weather/California/Los%20Angeles

-- gopher scheme for Gopher and Gopher+ Protocol services

http://www.math.uio.no/faq/compression-faq/part1.html

-- http scheme for Hypertext Transfer Protocol services

mailto:mduerst@ifi.unizh.ch

-- mailto scheme for electronic mail addresses

news:comp.infosystems.www.servers.unix

-- news scheme for USENET news groups and articles

telnet://melvyl.ucop.edu/

-- telnet scheme for interactive services via the TELNET Protocol

Format of URIs

- most generally
  - <scheme>:<scheme-specific-part>
- usually
  - <scheme>://<authority><path>?<query>
- useful <authority> is <server>
  - server = [[userinfo "@"] hostport]
    - hostport = host [“:” port]
    - host = hostname | IPv4address

Object Oriented Processing over the Internet

- resource pointed by URL = object
- “scheme” (and postfix of “path”) identify class
- path identify object within “server”
- “query” identify method
  - default method is “access”
- parameters may be specified in “query”

TCP and Command

- commands and replies represented in ASCII strings are exchanged over TCP
  - reply often begins with 3 digits followed by a space and text explaining reply in English
- line is terminated by CR and LF
- data may be sent over the same TCP connection (SMTP) or other TCP connection (FTP)
  - separator for data is necessary for sending over the same TCP

FTP (rfc959)

- File Transfer Protocol
- protocol to exchange files over the Internet
- port# 21 is used for command and response
- various file formats are supported

HTTP (HyperText Transfer Protocol, rfc2616)

- like FTP and SMTP, ASCII based exchange of commands and responces
- OPTIONS
  - ask what are the available options
- GET
  - retrieve content of resource including header
- HEAD
  - retrieve header of resource

HTTP (2)

- POST
  - send data to resource
- PUT
  - replace resource by a sent data
- DELETE
  - delete resource

HTTP (3)

- TRACE
  - get list of proxy chain
    - against E2E principle?
- CONNECT
  - reserved key word
    - to update proxy by tunneling

Meaning of HTTP Replies (1)

- 1xx: Informational
  - Request received, continuing process
- 2xx: Success
  - The action was successfully received, understood, and accepted
- 3xx: Redirection
  - Further action must be taken in order to complete the request

Meaning of HTTP Replies (2)

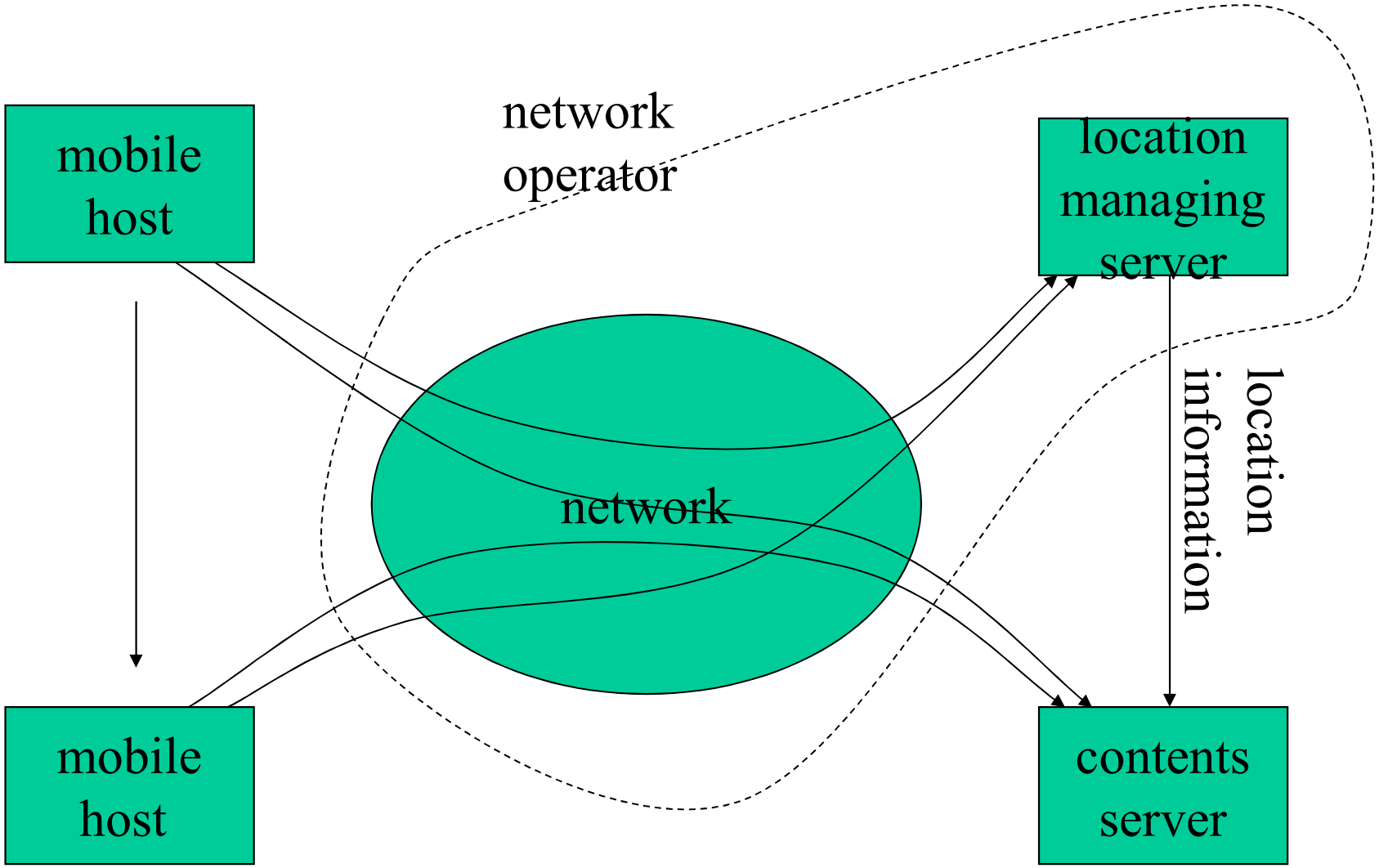
- 4xx: Client Error
  - The request contains bad syntax or cannot be fulfilled
- 5xx: Server Error
  - The server failed to fulfill an apparently valid request

Internet and Contents Regulation

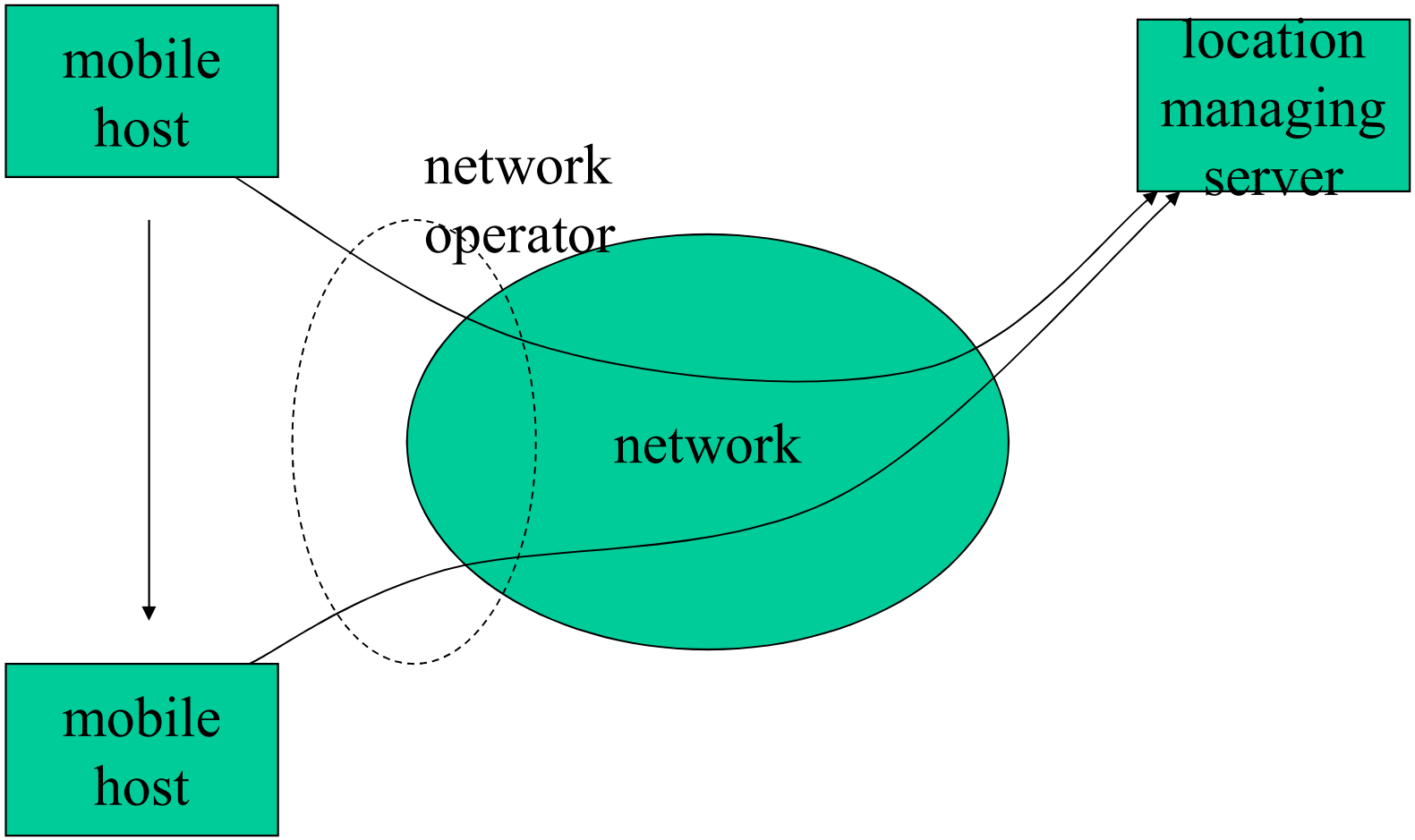
- with dial-up Internet access
  - server is centrally maintained by ISPs
  - (commercial) ISPs are easy to be regulated
- with persistent connectivity
  - anyone can operate servers
    - peer to peer model
  - must regulate all the end users
    - hard, though, not impossible

Location Dependent Service

- contents change according to location
- impossible at IP layer
  - no location information in IP header
  - may be possible at application layer
- how can location information obtained automatically?



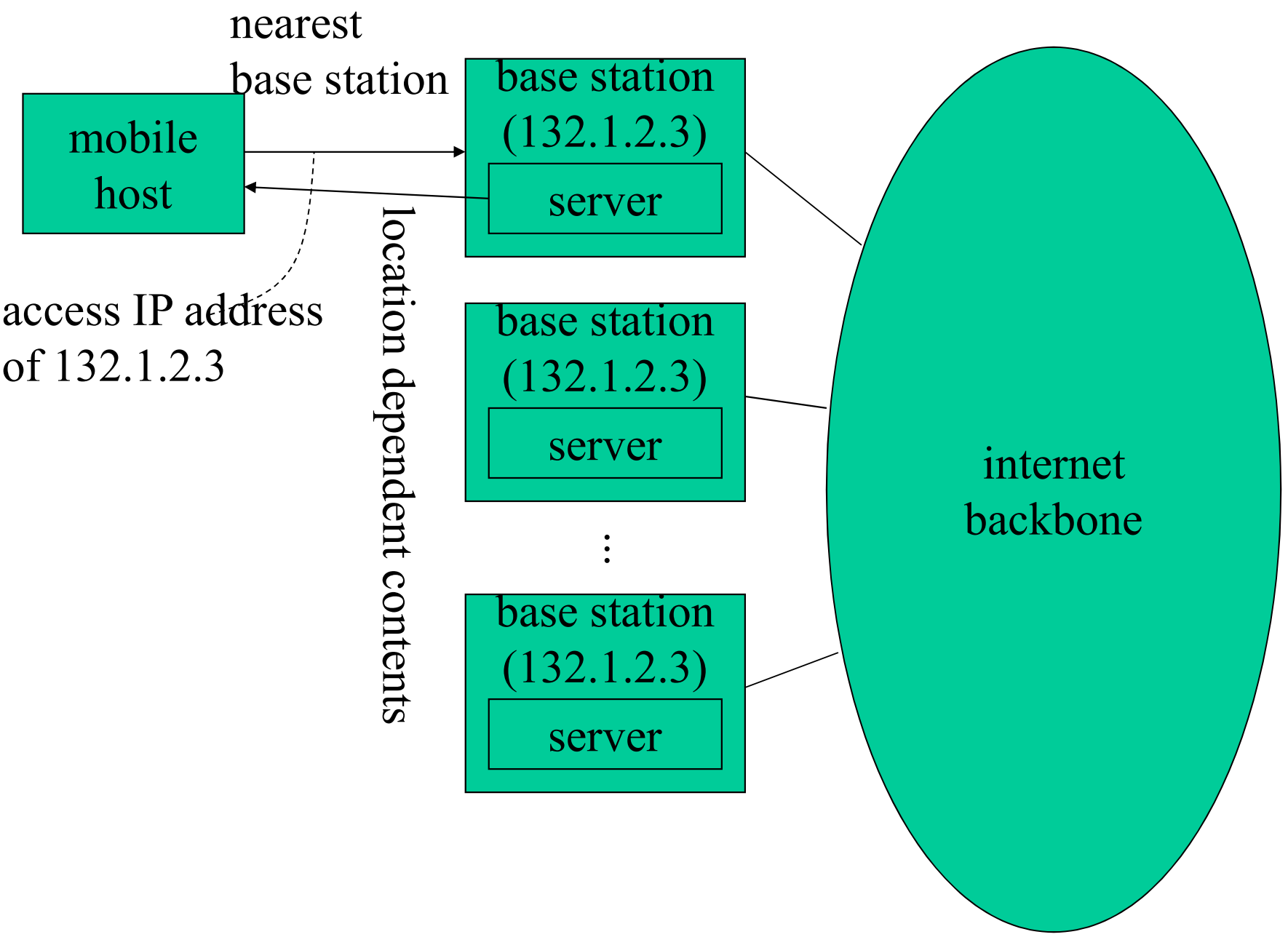
mobile hosts and location dependent contents in mobile phone network



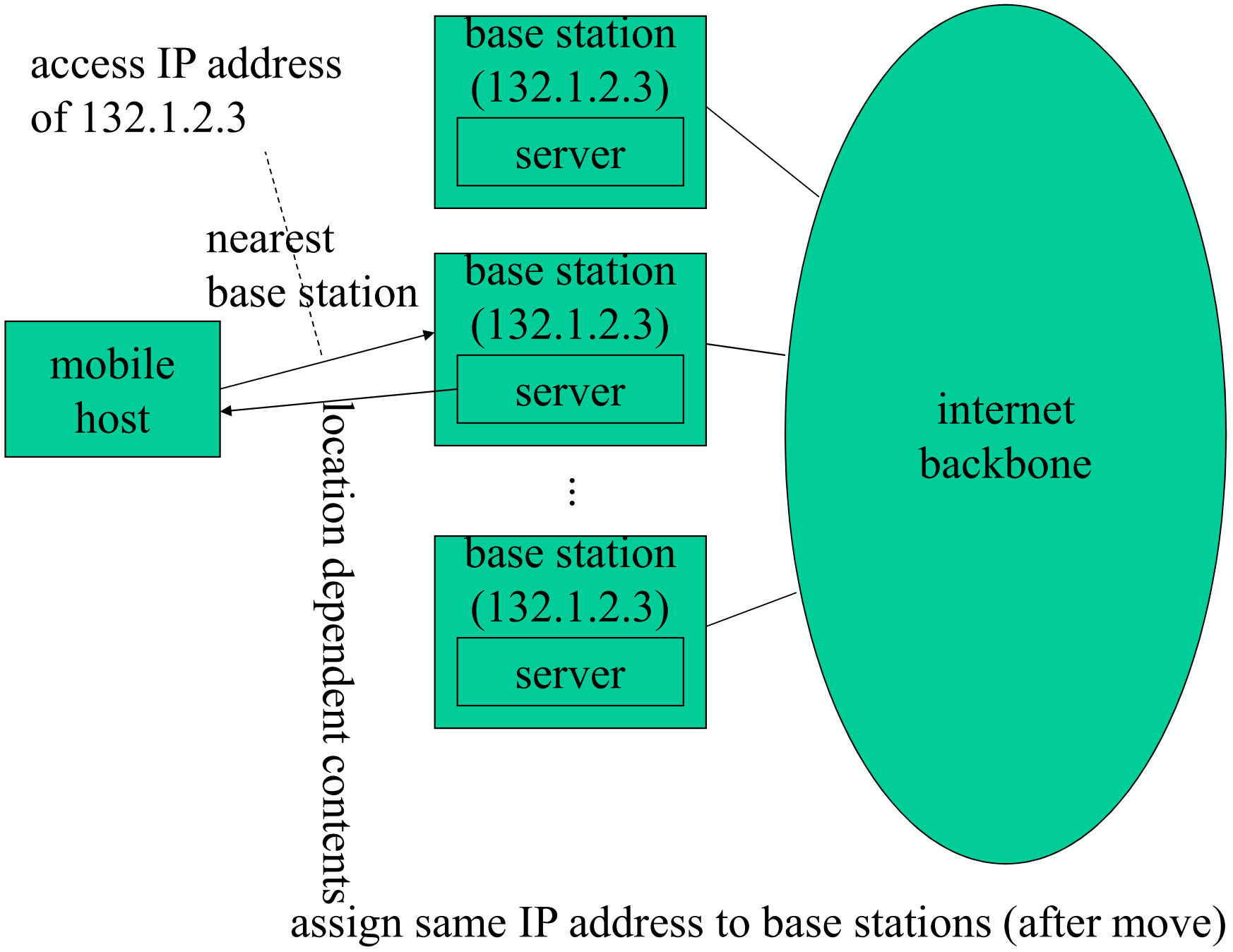
mobile hosts in the internet

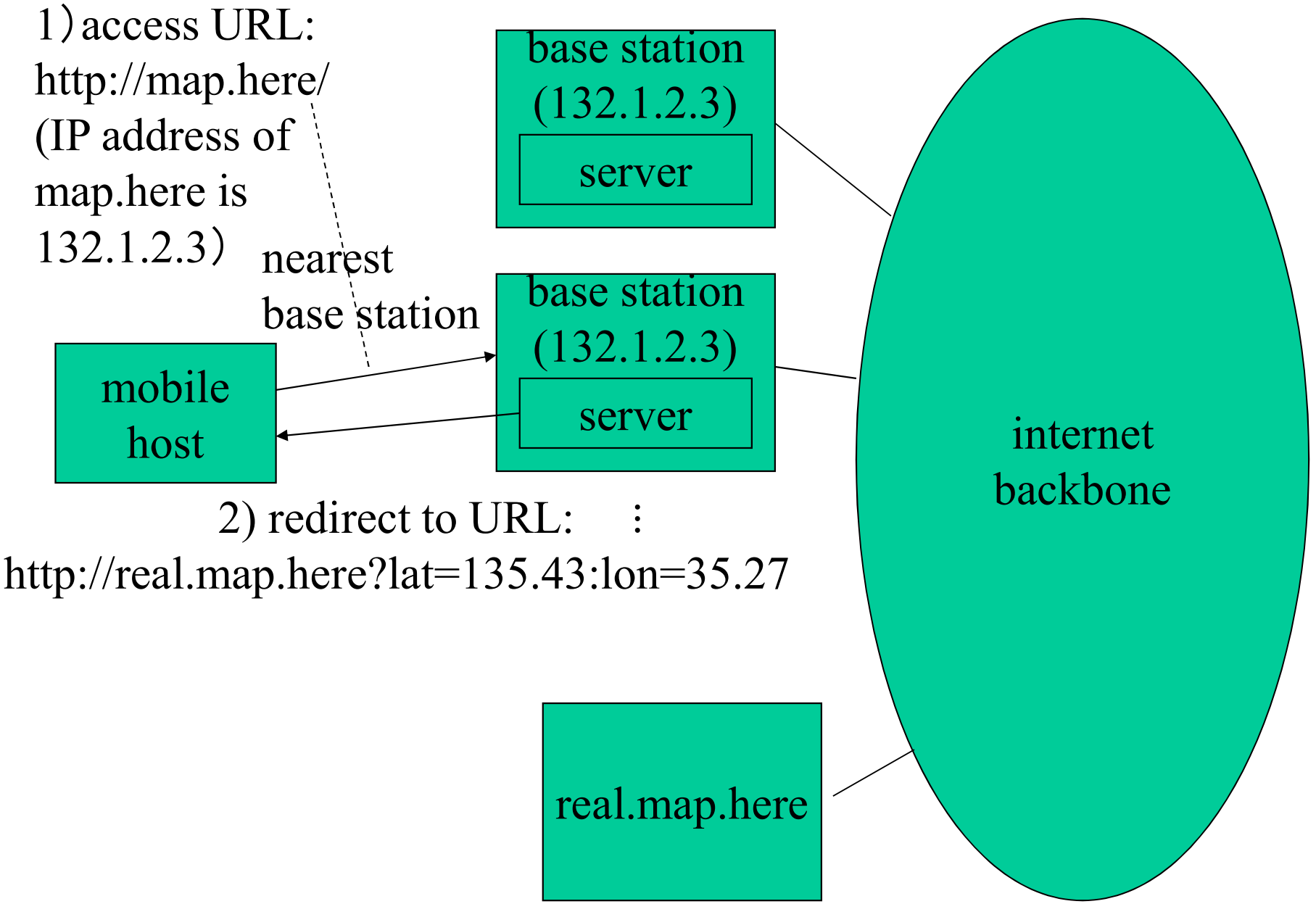
Distributed Location Dependent Service by Anycast

- assign an (anycast) IP address to multiple base stations at different locations
- mobile hosts access nearest base station by the address (specified by URL)
- base station offers location dependent contents
  - or, redirect to other URL with location information added

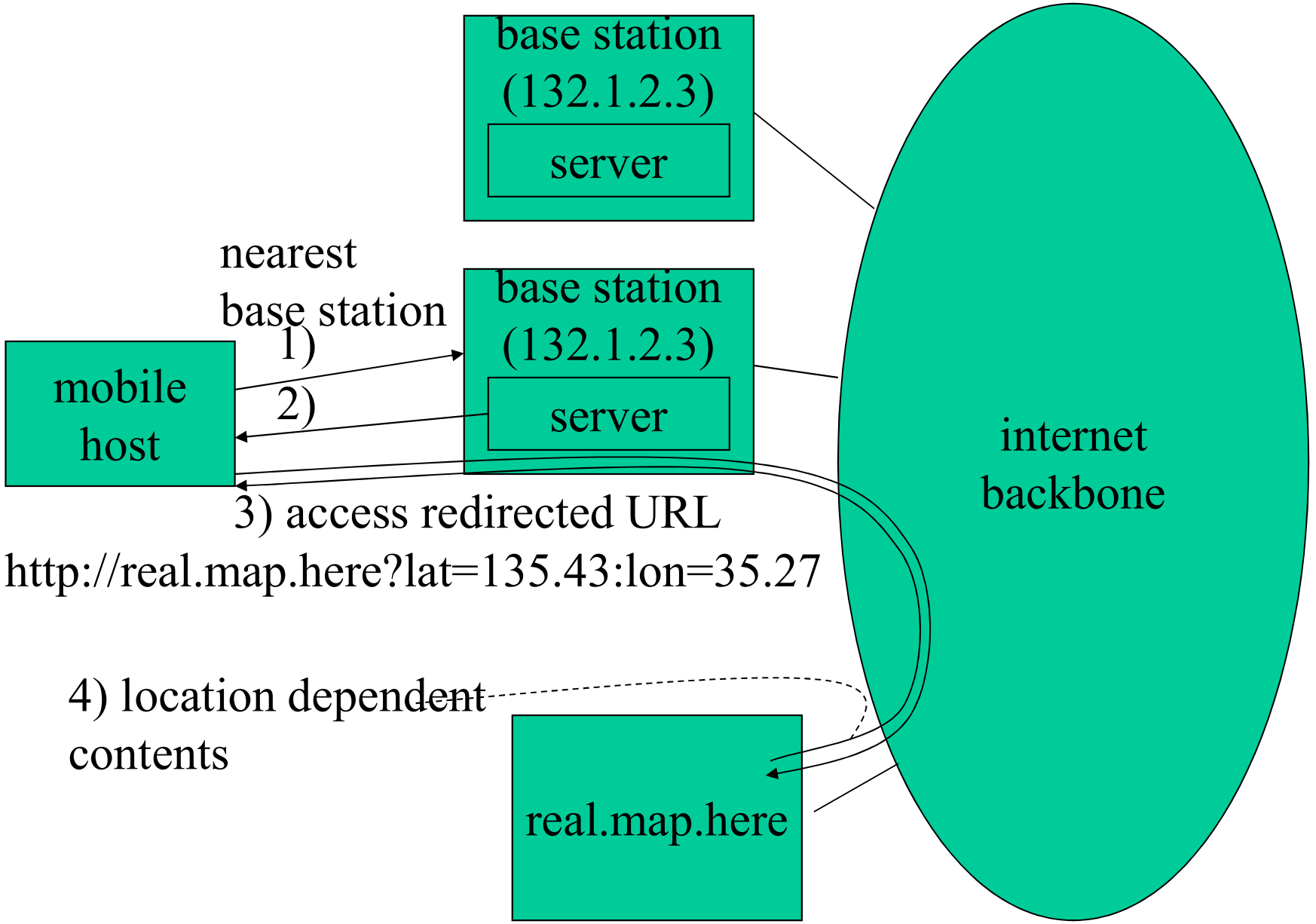


assign same IP address to base stations


access IP address
of 132.1.2.3
base station
(132.1.2.3)
server
nearest
base station
base station
(132.1.2.3)
server
mobile
host
internet
backbone
base station
(132.1.2.3)
server
location dependent contents
assign same IP address to base stations (after move)



example with URL and redirect



example with URL and redirect (cont'd)

Merit of Anycast based Approach

- fully distributed
- no privacy concern
  - location information is first offered to the user

JAVA (Script)

- embedded in HTML downloaded from server
- interpreted by client side
- client GUI can
  - initiate JAVA applet
    - may cause protocol actions
      - JAVA applet downloaded from server understand protocol
      - client do not have to understand protocol?

JAVA Applet

- even if client does not know protocols recognized by server
  - JAVA applet interpreted by browsers
    - can communication with server
- because human beings are involved through GUI
  - human beings know protocols used for text/graphical representations in web pages
    - ■: stop, ▶: play, ▶: record etc.

Standardization of JAVA API

- even if protocols are not standardized
  - if JAVA API is standardized
    - can control clients by JAVA code sent from server
- easier than standardizing protocols?
  - for people not familiar with networking, maybe
  - protocol standardization makes applets unnecessary
  - unconditional execution of programs from server may cause security problems
    - carefully designed protocols are better

Wrap Up

- web is the most commonly used application
  - smoothly migrated from e-mail/bbs era
    - thanks to E2E principle
  - client server model
- HTML is transferred by HTTP
  - URL represents objects
- JAVA is for computer experts without much network expertise