

SOURCE ROUTING
FOR
CAMPUS NETWORKS

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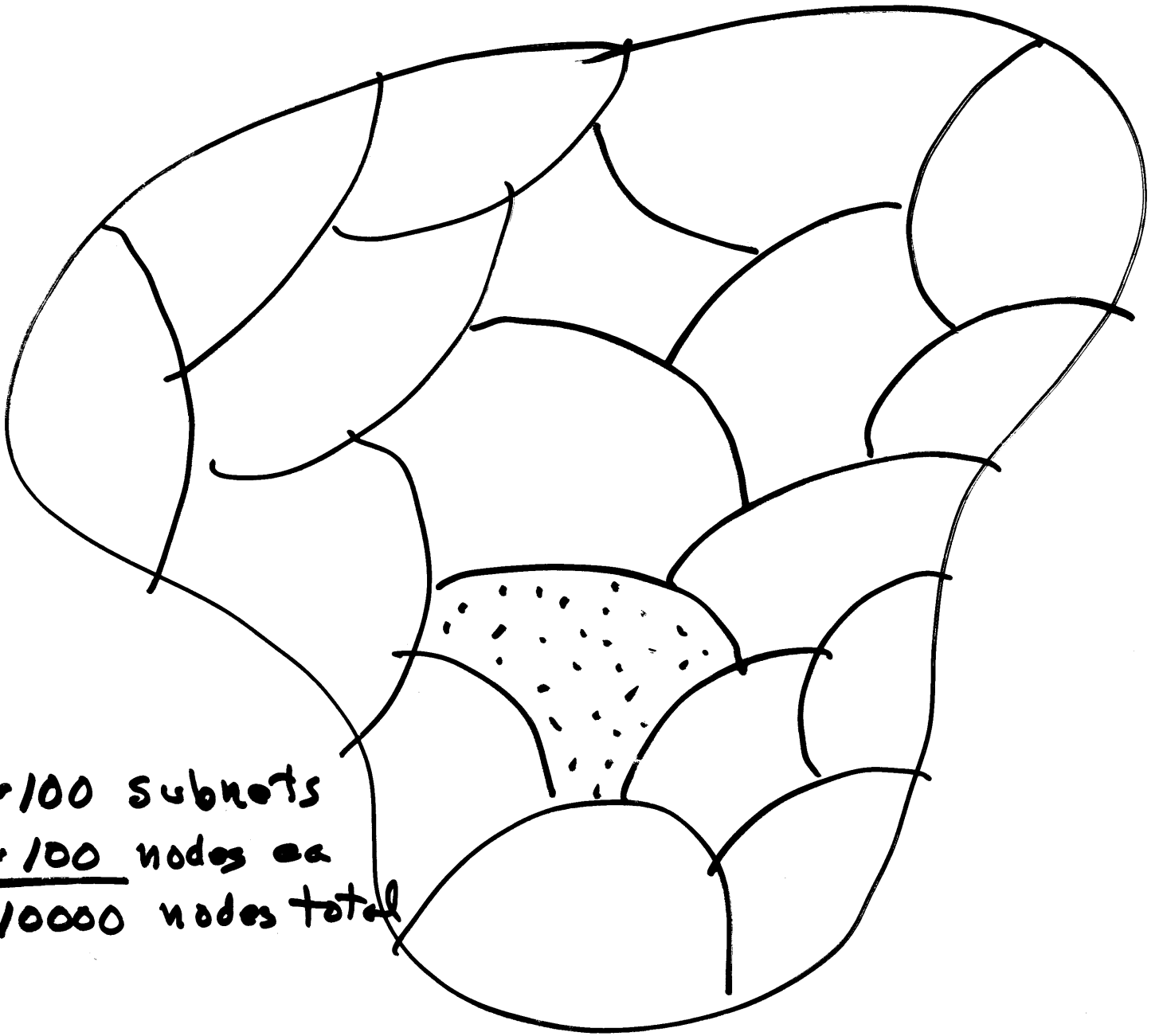
D. P. REED

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MASS. INST. OF TECH.

LAB FOR COMP. SCI.

CAMPUS



~100 subnets
~100 nodes ea
~10000 nodes total

← 1-2 km →

CHARACTERISTICS OF CAMPUS ENVIRONMENT

1. HIGH BANDWIDTH

- 7-10 Mb/sec

Technology can
be deployed

- NO "common carrier"
(P.T.T.) required

2. LOW-PROFILE ADMINISTRATION

- Primary purchase
consideration is

this application's
need, not comm.
with other apps.

- Confederation of
private subnetworks

CHARACTERISTICS OF CAMPUS ENVIRONMENT

1. HIGH BANDWIDTH

- OPTIMAL USE CAN BE SECOND PRIORITY

2. LOW-PROFILE ADMINISTRATION

- NET MUST BE SELF-SURVIVING
- UNATTENDED GATEWAYS
- TROUBLE ISOLATION BY CUSTOMER
- INADEQUATE MONITORING
- UNOFFICIAL GATEWAYS

GATEWAY FUNCTION :

HOP-BY-HOP

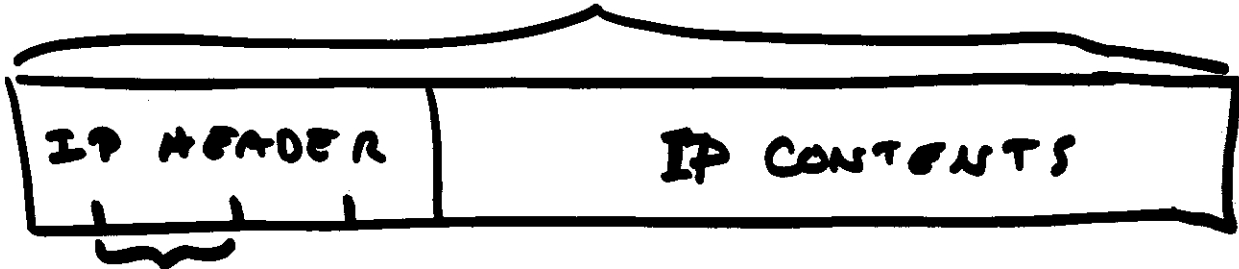
ROUTE : GATEWAY CHOOSES NEXT STEP BASED ON DESTINATION AND ITS OWN BEST JUDGEMENT

SOURCE ROUTE : GATEWAY FINDS NEXT STEP INSIDE PACKET

SOURCE ROUTE → SIMPLE GATEWAY

MECHANICS

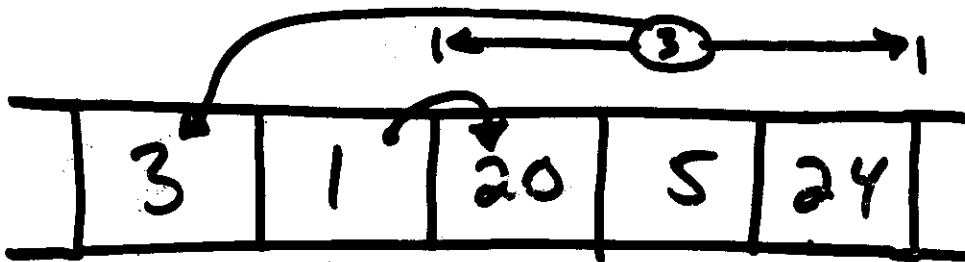
IP PACKET



DESTINATION
FIELD

HOP-BY-HOP: INTERNET
IDENT OF DESTINATION

SOURCE ROUTE: LIST OF
LOCAL NET ADDRESSES TO
USE ALONG THE WAY



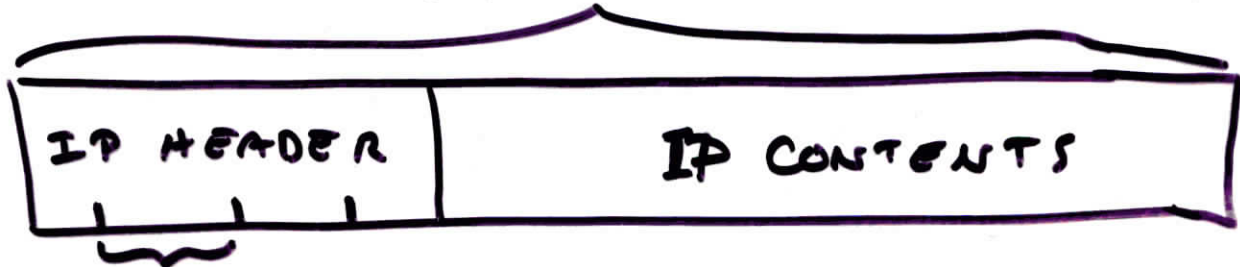
route count next hop hop 1 hop 2 hop 3

source route

MECHANICS

ALLOWS UNIFORM TREATMENT OF FINAL FAN-OUT

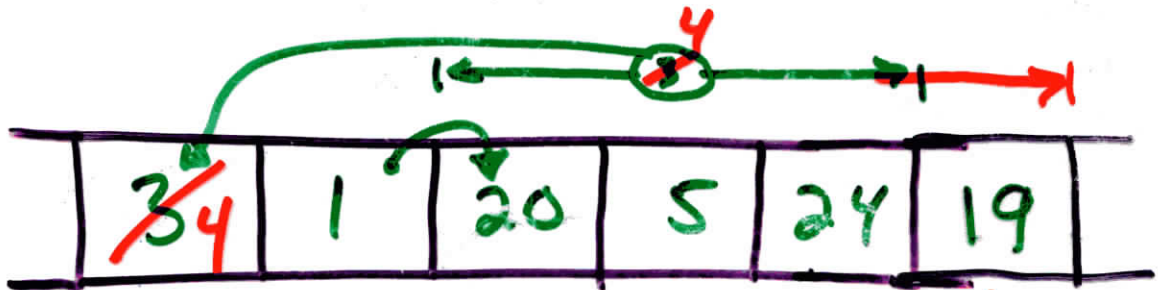
IP PACKET



DESTINATION FIELD

HOP-BY-HOP: INTERNET IDENT OF DESTINATION

SOURCE ROUTE: LIST OF LOCAL NET ADDRESSES TO USE ALONG THE WAY

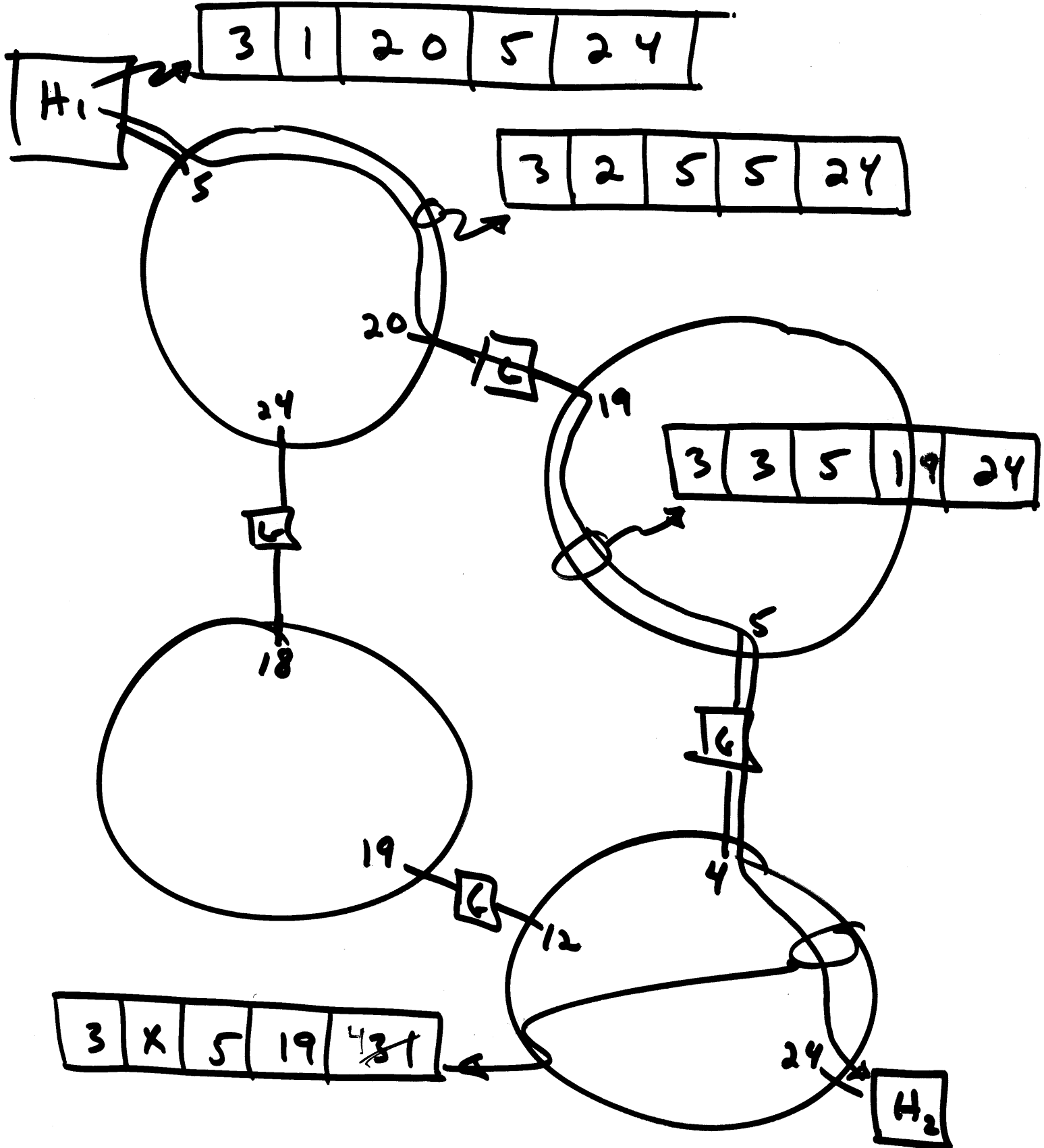


route count next hop hop 1 hop 2 hop 3

TARGET ACTIVITY IN TARGET HOST

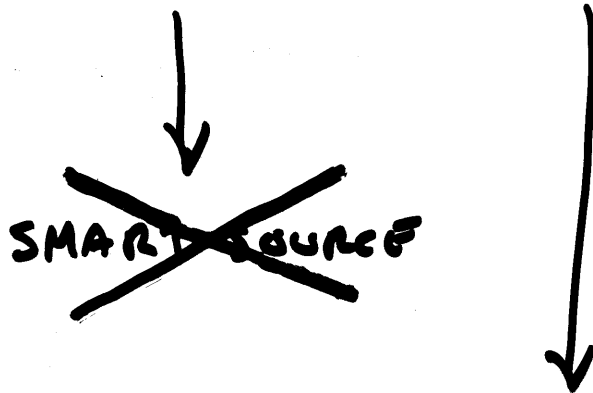
source route

EXAMPLE (REVERSE ROUTE CONSTRUCTION)

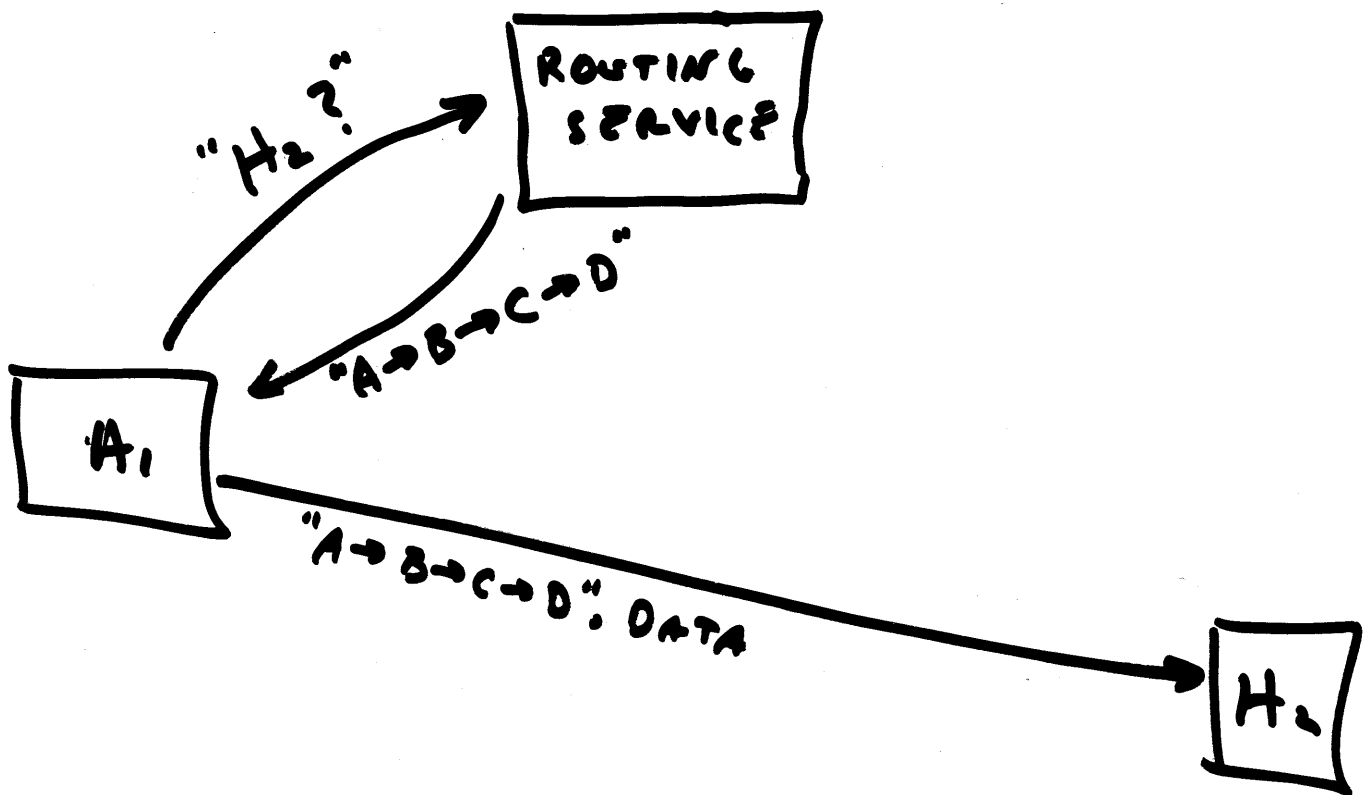


WHERE ROUTES COME FROM

SOURCE PLACES THEM IN PACKET



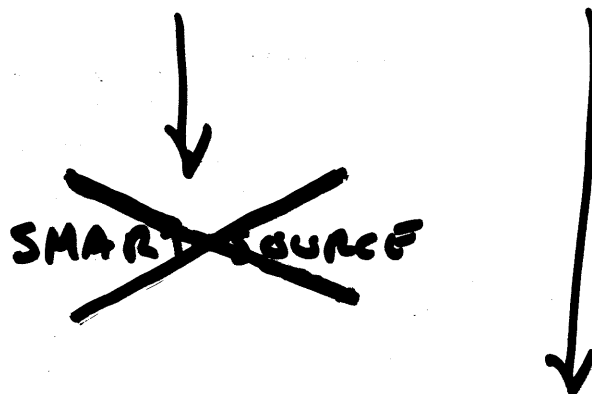
SOURCE ASKS ROUTING SERVICE



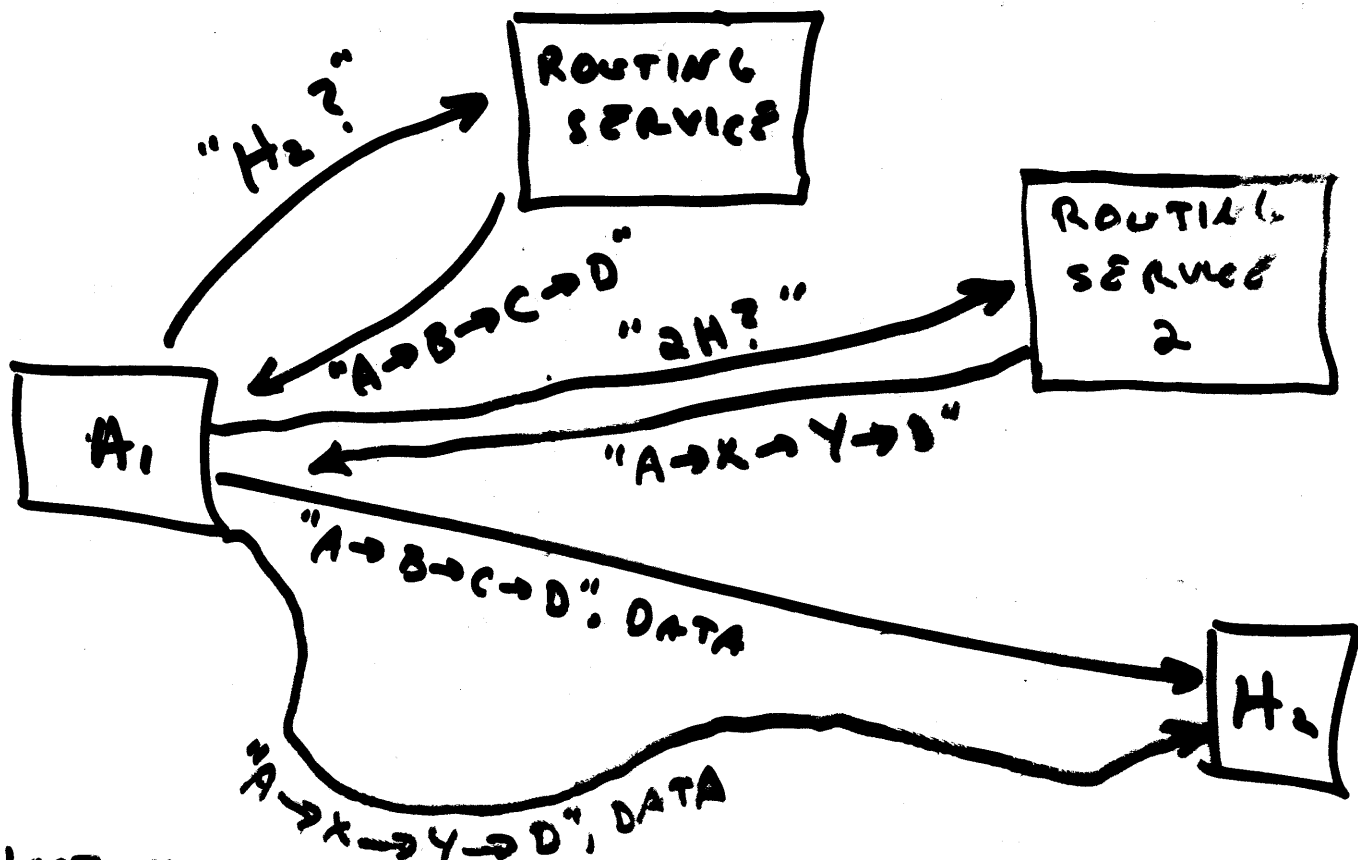
HOST MUST FIND ROUTE TO NEAREST ROUTING SERVICE
(SUPPLIED BY NEAREST GATEWAY/BROADCAST)

WHERE ROUTES COME FROM

SOURCE PLACES THEM IN PACKET



SOURCE ASKS ROUTING SERVICE



HOST MUST FIND ROUTE TO NEAREST ROUTING SERVICE
(SUPPLIED BY NEAREST GATEWAY/BROADCAST)

ADVANTAGES OF SOURCE ROUTES

- SEPARATES INTERNET IDENTIFICATION FROM INTERNET ROUTING MECHANICS
- SIMPLIFIES GATEWAYS
- ALLOWS ROUTE CONTROL
- SOLVES SEVERAL MINOR PROBLEMS

ADVANTAGES OF SOURCE ROUTE

- SEPARATES INTERNET IDENTIFICATION FROM INTERNET ROUTING MECHANICS
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DISADVANTAGES

- LESS DYNAMIC -- PERFORMANCE LOSS
- EXTRA PROTOCOL STEP

SEPARATING ROUTING FROM TARGET IDENTIFICATION

HOW - BECAUSE GATEWAYS NEVER EXAMINE
TARGET ID'S. ONLY ROUTING
SERVICES DO.

VIRTUES -

- CAN HAVE SEVERAL ID RESOLUTION
TECHNIQUES OPERATING AT ONCE
(INCL. PRIVATE AGREEMENTS)
- CAN IMPROVE ID ASSIGNMENT PLAN
WITHOUT TOUCHING EVERY GATEWAY
- LINK/SOCKET FIELD ARGUMENTS VANISH
↳ LAST STEP OF ROUTE
+ UNIQUE CONNECTION ID

SIMPLIFIED GATEWAYS

WHY SIMPLE?

- NO DECISIONS
- NO MEMORY

VIRTUES -

- TRIVIAL RECOVERY / POWER-UP
- HIGH BANDWIDTH
- LOW FAILURE RATE, EASY MAINTENANCE
- QUICK IMPLEMENTATION
- SAFE TO INSTALL INSIDE KERNEL
(FOR PERFORMANCE)

ALLOWS ROUTE CONTROL

USES -

- TROUBLE ISOLATION -- OUT-AND-BACK PACKETS, SOURCE DEBUGGING
- POLICY COMPLIANCE (e.g. "GOV'T BUSINESS ONLY" ON NET 15)
- CLASS-OF-SERVICE -- ERROR RATE, DELAY, PRIVACY
- FIFO STRIPES
- PRIVATE GATEWAYS

SOLVES MINOR PROBLEMS

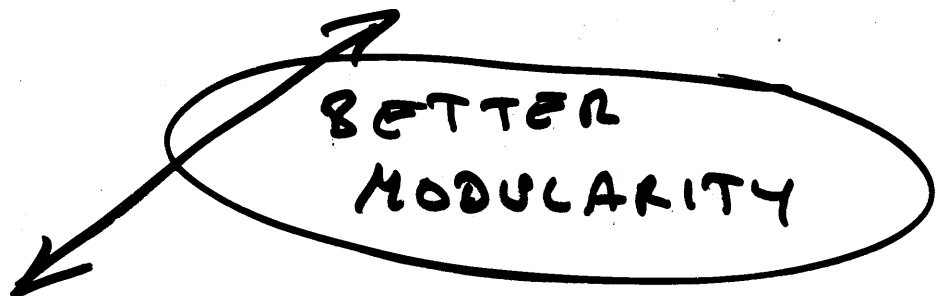
- NO WORRY ABOUT LOOPS, STABILITY, HOP COUNTS, OR CONSISTENCY OF GATEWAY TABLES
- FRAGMENTATION STRATEGY NOT FROZEN IN TO GATEWAY IMPLEMENTATIONS
- MULTI-HOMING PROBLEM (HOSTS ON SEVERAL NETS) MOVES FROM GATEWAYS TO ROUTING SERVICE.
- VARIATIONS ON SERVICE DO NOT REQUIRE UPDATING ALL GATEWAYS

CONCLUSIONS

DIVERSITY OR
ADMINISTRATION



SOURCE ROUTING



DECOUPLES GATEWAY
FROM ARGUMENTS