# RINGS, ETHERNETS, AND BROADBAND

## THE UNDERPINNINGS OF LOCAL NETWORKS

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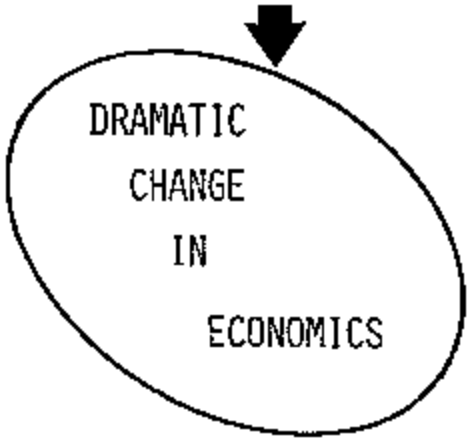
# WHAT MAKES A LOCAL NET DIFFERENT?

SECONDARY DIFFERENCES

- HIGH BANDWIDTH
- LOW COST
- SHORT DISTANCE

PRIMARY DIFFERENCE

- NO COMMON CARRIER INVOLVED



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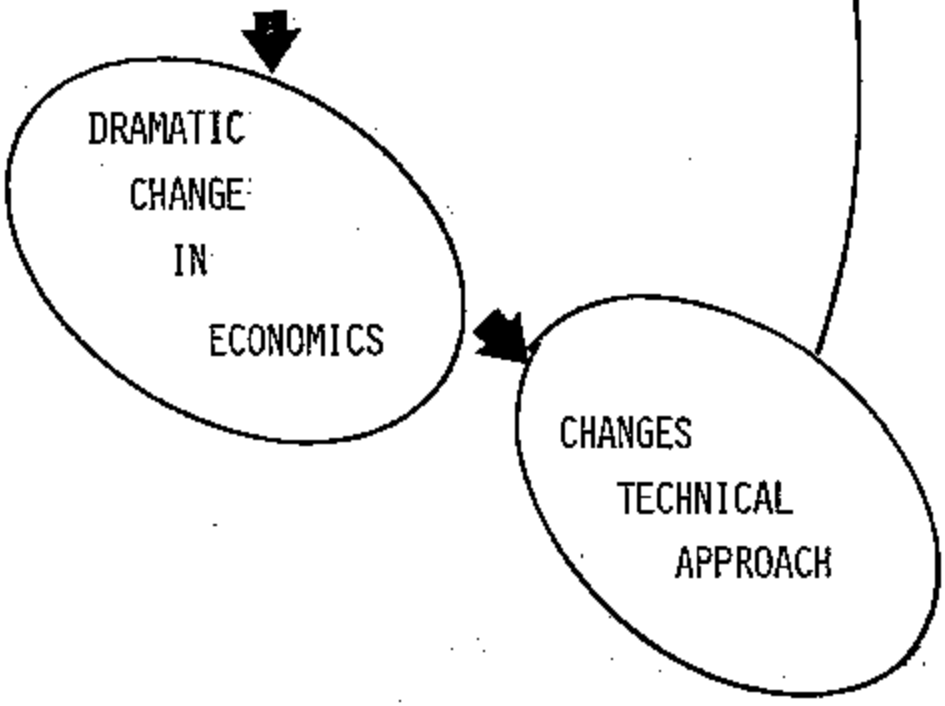
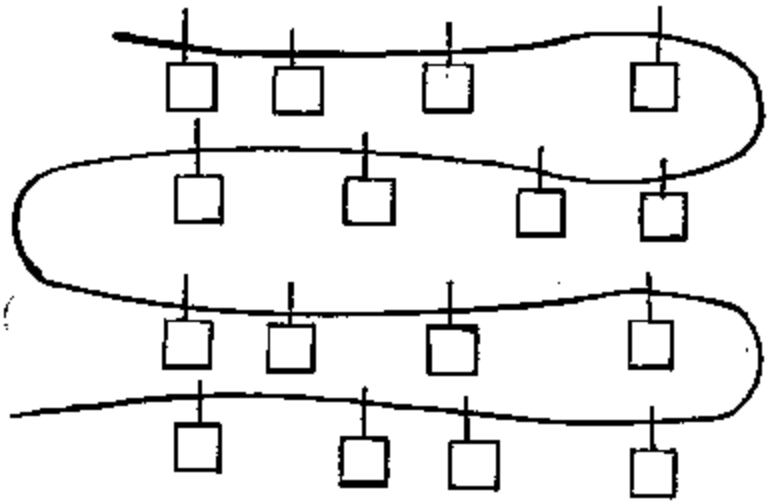


# ECONOMICS

EXAMPLE — 30 COMPUTERS,
1 KM MAX. SEPARATION

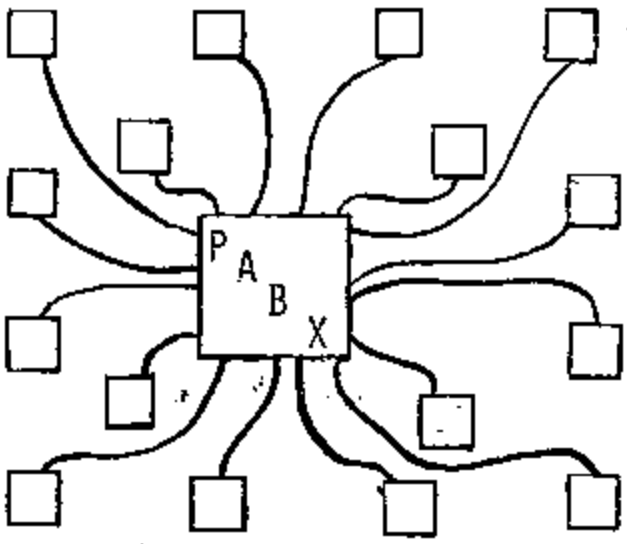
## ① ETHERNET (10 MBIT/SEC)



| | |
|---|---|
| WIRE, 2.5KM @ $2/M | 5000 |
| MODEMS, 30 @ $300 | 9000 |
| | $14000 |

OR $500 / NODE (PURCHASE)
$20 / MONTH (RENTAL)

## ② TELEPHONE COMPANY, FOR $20/MONTH




10 KB/SEC MODEMS

CENTRAL SWITCH

15 CONNECTIONS @ 10 KB/S
= 150 KB/SEC AGGREGATE

## R A T I O S

| | | |
|---|---|---|
| PEAK DATA RATE | $\frac{10 \text{ MBIT/SEC}}{10 \text{ KBIT/SEC}}$ | = x1000 |
| AGGREGATE DATA RATE | $\frac{10 \text{ MBIT/SEC}}{150 \text{ KBIT/SEC}}$ | = x 66 |

## W H Y ?

30 - 40 YEAR AMORTIZATION

↓

AVERAGE ECONOMIC AGE = 15 - 20 YEARS

↓

PLANT IS PRICED @ 1961 - 66 PRICES

1963: IBM 7094 — $\$2.5 \times 10^6$

1981: IBM DISPLAYWRITER — $\$7.5 \times 10^3$

} x 300

## IMPACT

① DESIGN DIFFERENCES

LOCAL → SIMPLICITY

LONG-HAUL → EFFICIENCY

② PEAK RATE SUPPORTS SOME APPLICATIONS

- MOVE FILE TO PRINTER
- MOVE DATA FROM REPOSITORY TO PROCESSING CENTER
- SEND MESSAGE

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## WHERE AVAILABLE — 2 PLACES

① ON-SITE, IN-PLANT (COMMON OWNER)

② COMMUNITY 2-WAY CABLE T.V.

# NETWORK TECHNOLOGY SELECTION CRITERIA

— MOST EFFICIENT USE OF MEDIUM

— FEWEST DROPPED BITS

# NETWORK TECHNOLOGY SELECTION CRITERIA

~~— MOST EFFICIENT USE OF MEDIUM~~

~~— FEWEST DROPPED BITS~~

} NOT SO IMPORTANT — LOCALLY, LOW NOISE AND HIGH BANDWIDTH ARE CHEAP

— HIGH AVAILABILITY

— EASY INSTALLATION AND RECONFIGURATION

— EASY REPAIR

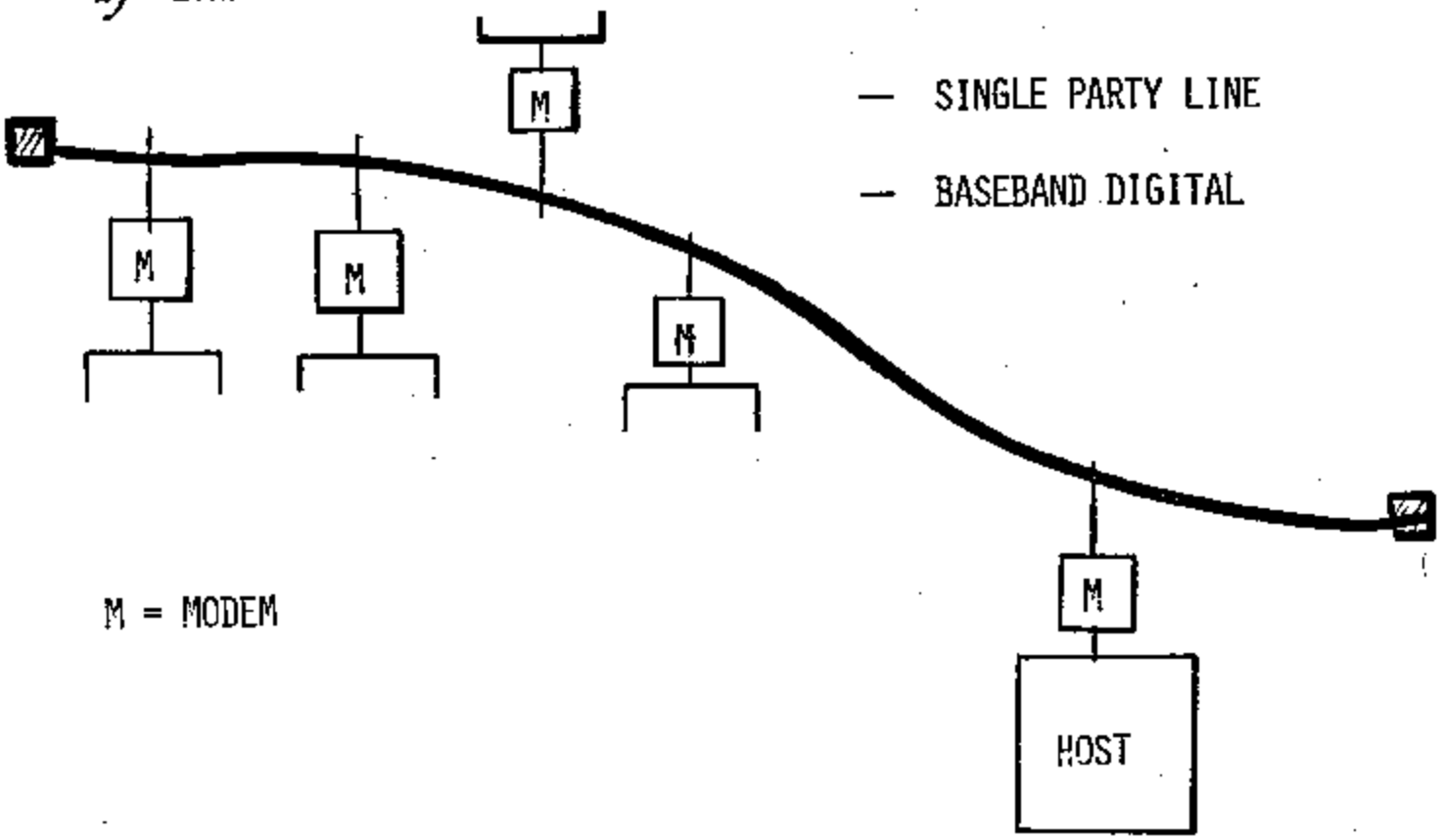
— LOW HARDWARE COMPLEXITY

— LOW COST PER STATION

} THESE ARE WHAT COUNT !

# HOW THEY WORK

## 1) ETHERNET




— SINGLE PARTY LINE

— BASEBAND DIGITAL

M = MODEM

METHOD

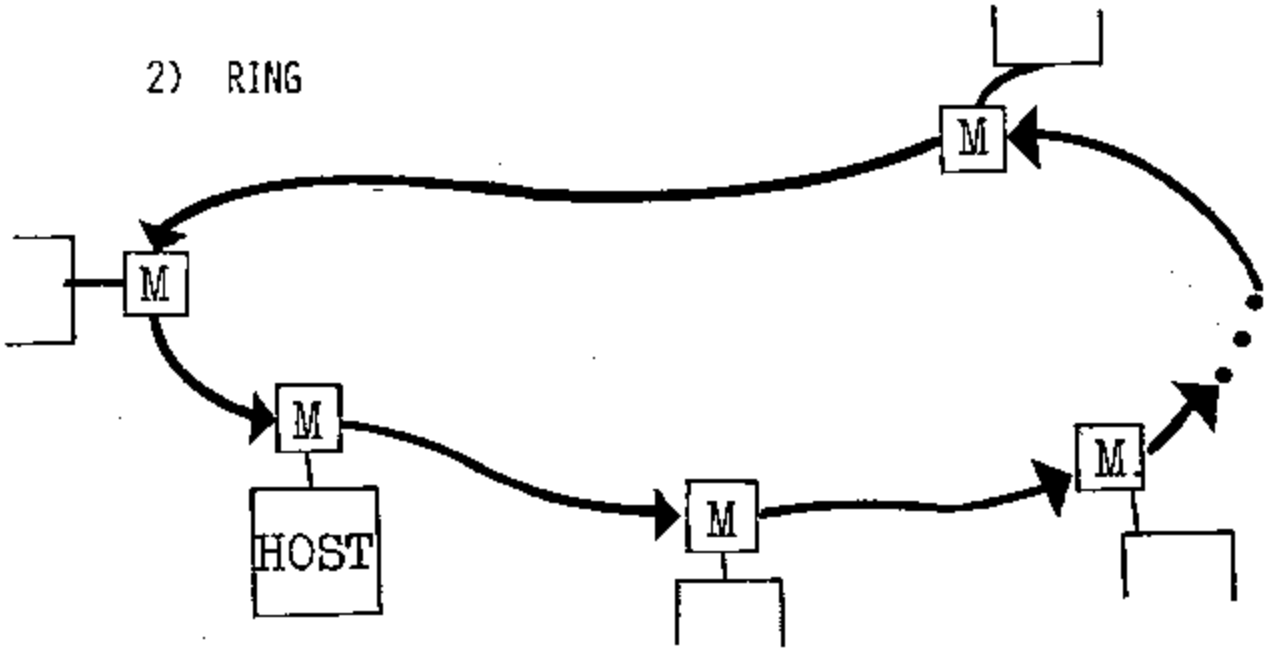
1) WAIT FOR QUIET LINE
2) SEND PACKET @ 10 MBIT/SEC
3) LISTEN WHILE TALKING, IF INTERFERENCE, STOP-WAIT-RETRY

↓

"CARRIER SENSE MULTI-ACCESS, WITH COLLISION DETECT"
CSMA/CD
OR, SIMPLY, ACCESS DETERMINED BY CONTENTION

# HOW THEY WORK

2) RING




— DIGITAL REPEATERS
— CIRCULAR CONFIGURATION
— CIRCULATING TOKEN

SPECIAL BIT PATTERN

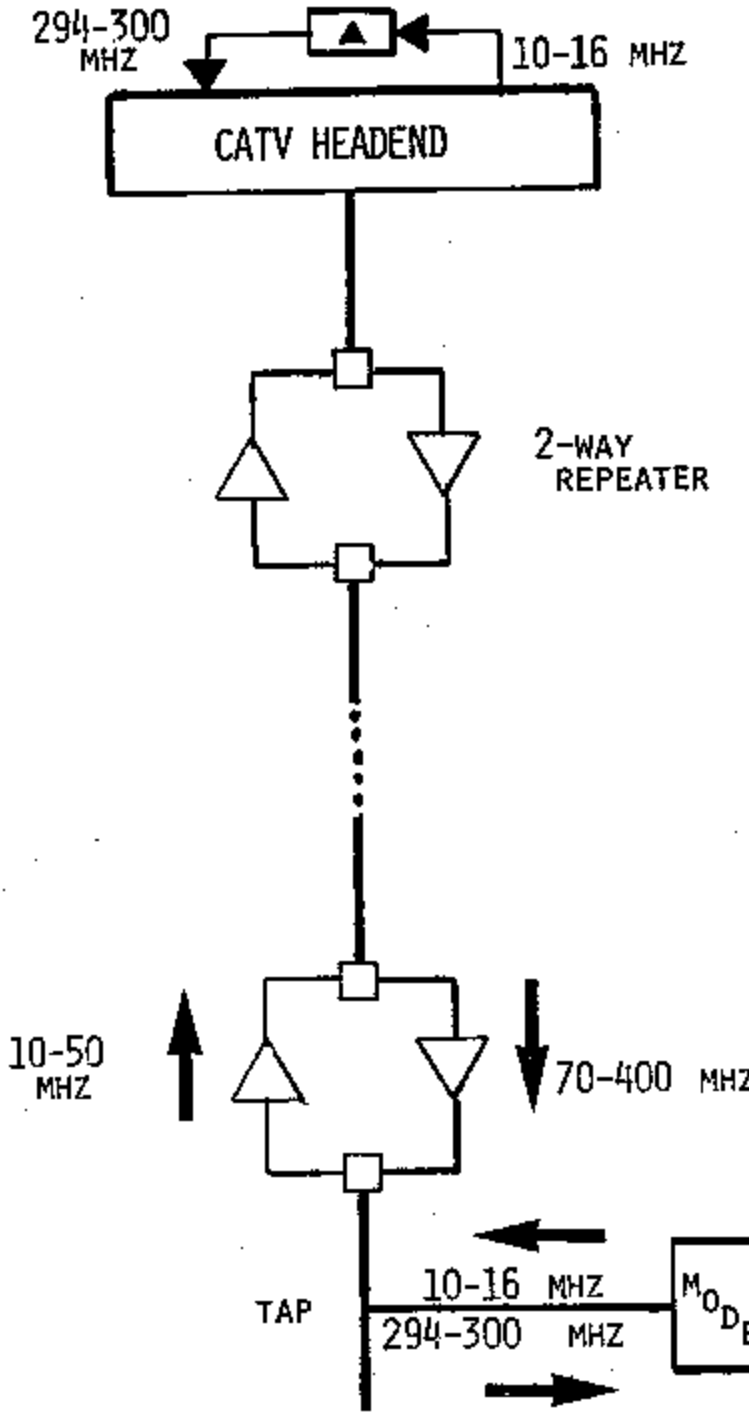
METHOD

1) WAIT TILL TOKEN COMES BY, TAKE IT
2) OPEN RING, SEND MESSAGE
3) SEND NEW TOKEN
4) TAKE OWN MESSAGE OFF, CLOSE RING

ACCESS CONTROL BY TOKEN-PASSING

# HOW THEY WORK

## 3) BROADBAND




— USE ONE INBOUND + ONE OUTBOUND TV CHANNEL FOR DATA

— COPY IN → OUT AT HEADEND

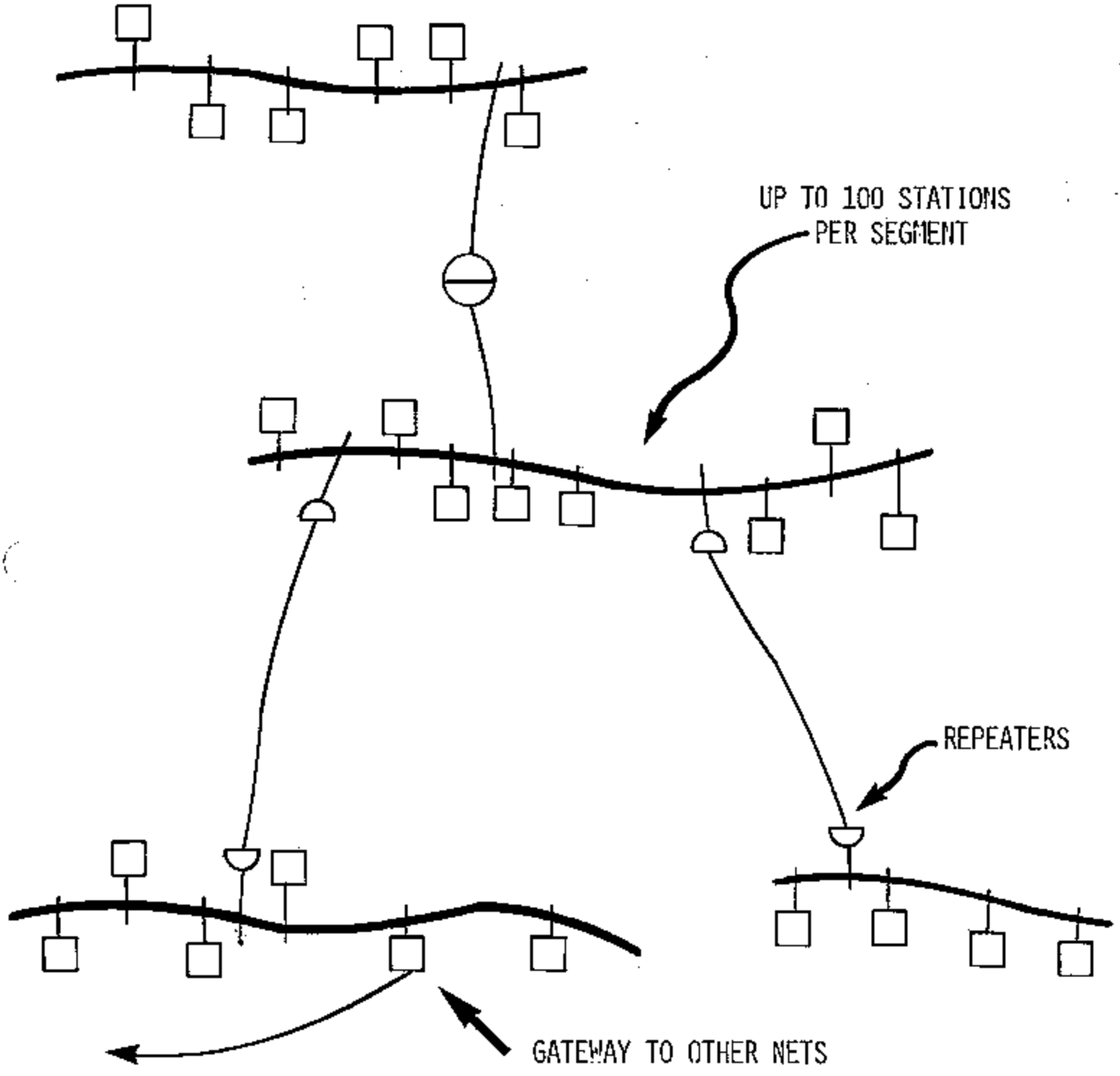
— MODEM AT EACH DATA SITE

— CAN RUN 2 MBIT/SEC ON ONE TV CHANNEL

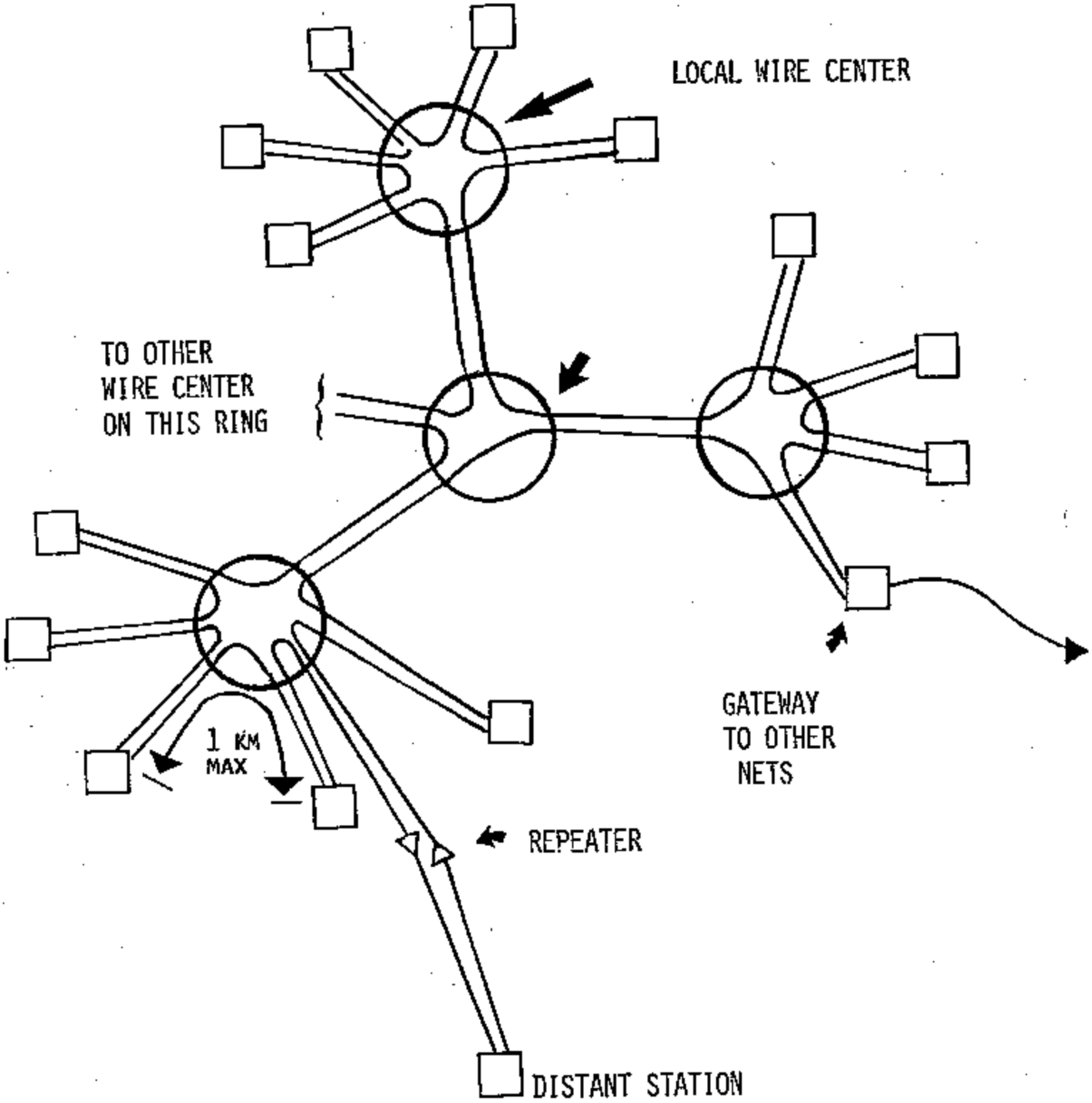
— CAN ALSO HAVE 50 TV CHANNELS

ACCESS: CSMA/CD, JUST LIKE ETHERNET

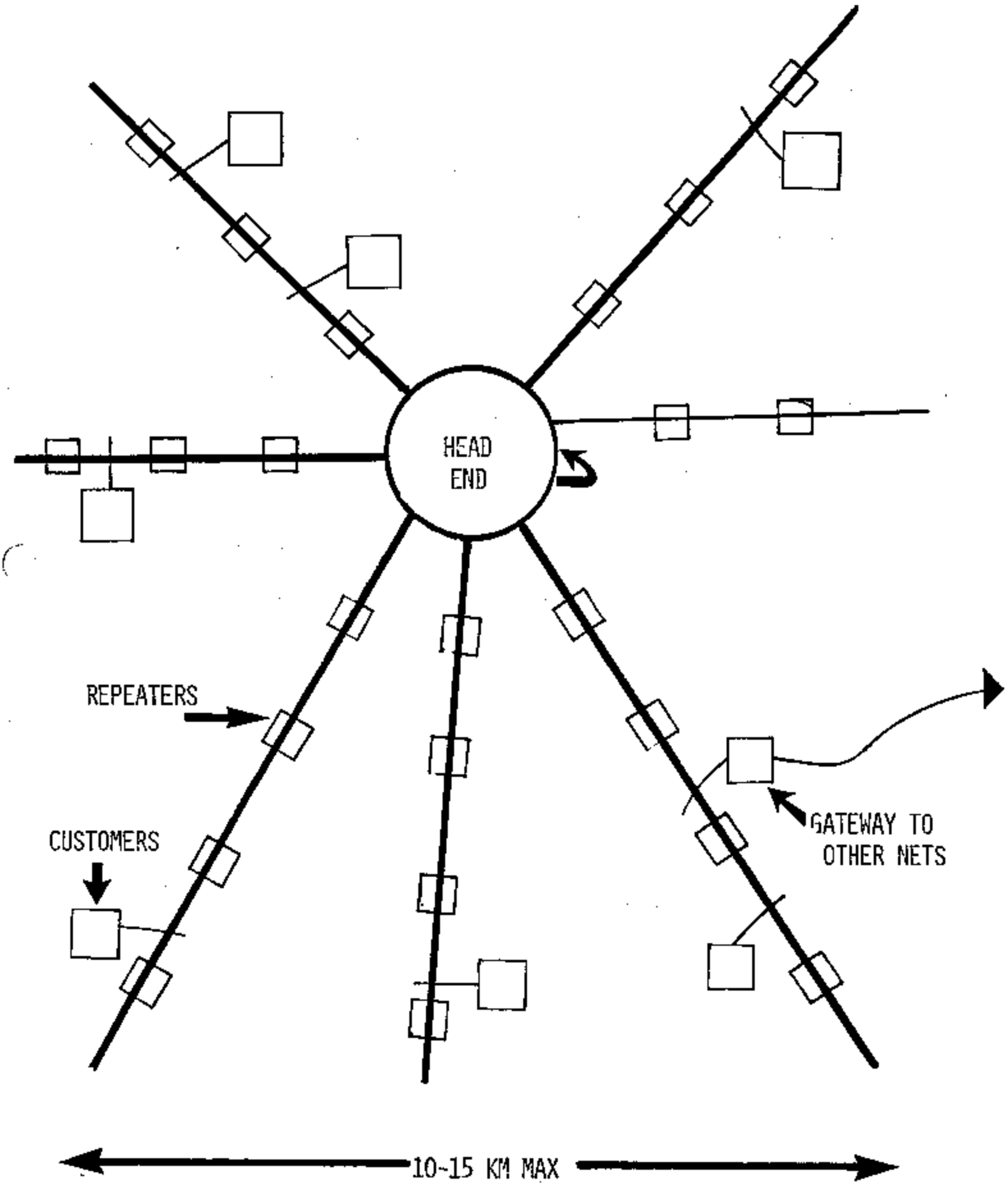
# SYSTEM VIEW - ETHERNET



SYSTEM VIEW - RING



# SYSTEM VIEW-BROADBAND/CATV



## PRIMARY ADVANTAGES

ETHERNET

—— ONLY ONE WIRE
TO INSTALL

RING

—— SIMPLE POINT-TO-POINT
SIGNALLING

BROADBAND

___ PIGGY-BACK ON CATV-
NO WIRES TO INSTALL

## PRIMARY ADVANTAGES

ETHERNET

— ONLY ONE WIRE TO INSTALL

XEROX
DEC
INTEL
3COM, ETC.

RING

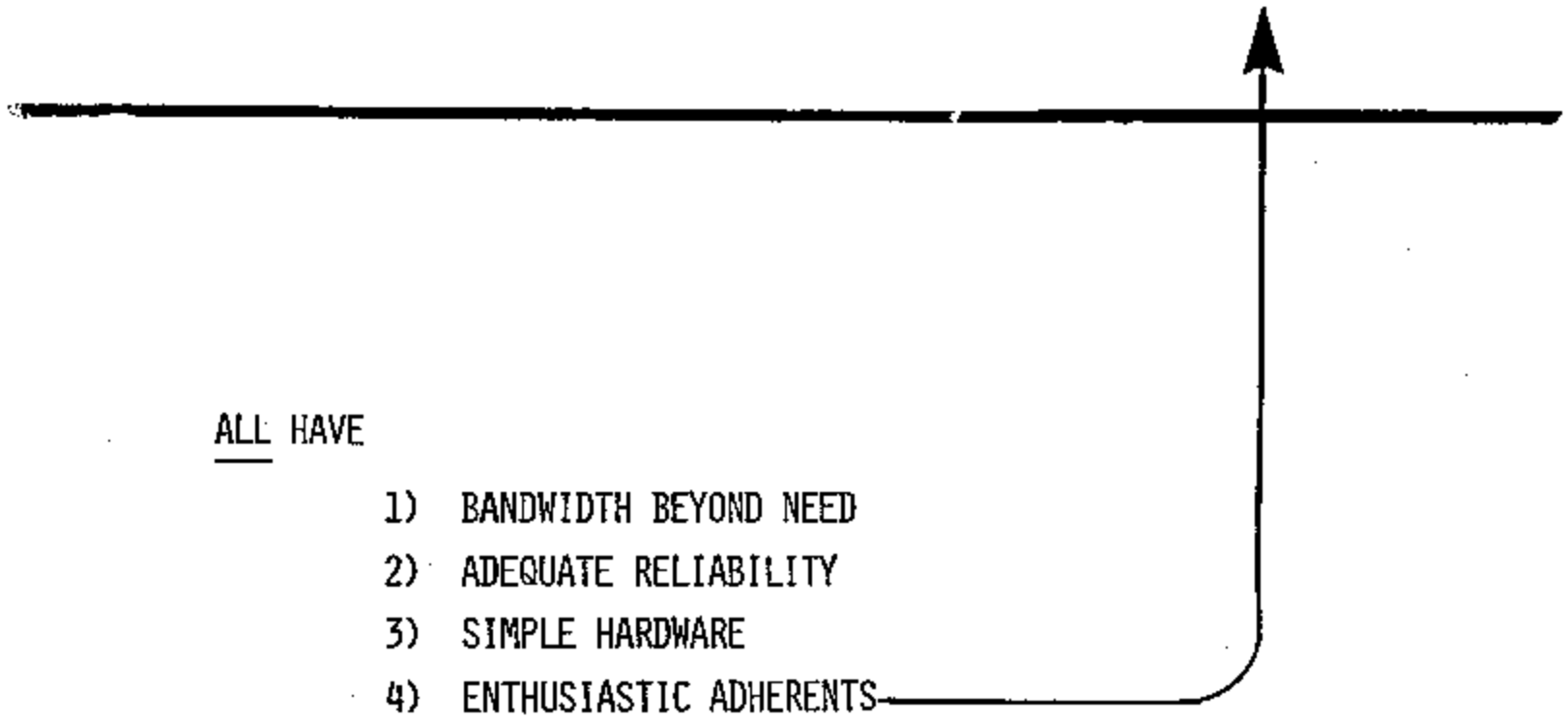
— SIMPLE POINT-TO-POINT SIGNALLING

IBM
APOLLO
PRIME
ETC.

BROADBAND

— PIGGY-BACK ON CATV- NO WIRES TO INSTALL

M/A COM
SYTEK



ALL HAVE

1) BANDWIDTH BEYOND NEED
2) ADEQUATE RELIABILITY
3) SIMPLE HARDWARE
4) ENTHUSIASTIC ADHERENTS

# M Y T H S

ETHERNET: CONTENTION =
"NON-DETERMINISTIC" =
BAD

RING: REPEATER RELIABILITY IS LOW

BROADBAND: CATV DISTANCES TOO GREAT
FOR CSMA/CD

# M Y T H S

ETHERNET: CONTENTION =
"NON-DETERMINISTIC" =
BAD

—— WHEN ERRORS CONSIDERED, ALL NETS ARE "NON-DETERMINISTIC"

—— CAN SYSTEMATICALLY CONTROL DELAY

RING: REPEATER RELIABILITY IS LOW

—— EXPERIENCE → DIGITAL LOGIC RELIABLE ENOUGH

—— RELAY CUTOUT IS ADEQUATE RESPONSE

BROADBAND: CATV DISTANCES TOO GREAT
FOR CSMA/CD

—— 6 MHZ CHANNEL 2 MBIT/SEC DATA RATE

—— 400 MHZ SYSTEM 14 MI MAX DIA CIRCLE

JUST FITS !

# WHAT ARE THE IMPORTANT DIFFERENCES?

ENGINEERING EASE

- —— POINT-TO-POINT VS. BROADCAST
- —— GROUNDING/ISOLATION -EMC
- —— PROTOCOL SIMPLICITY

OPERATIONS

- —— TROUBLE ISOLATION
- —— REPAIR
- —— INSTALLATION EASE
- —— RELIABILITY

SCALE MAXIMUM

- —— DISTANCE VS. SPEED TRADEOFF WITH CONTENTION

FUTURE USE OF OPTICS

- —— BROADCAST OPTICS ENERGETICS
- —— SPEED

# WHAT ARE THE IMPORTANT DIFFERENCES?

| | FAVORS |
|---|---|
| ENGINEERING EASE | ↓ |
| — POINT-TO-POINT VS. BROADCAST | RING |
| — GROUNDING/ISOLATION -EMC | RING |
| — PROTOCOL SIMPLICITY | ETHER, CATV |
| OPERATIONS | |
| — TROUBLE ISOLATION | RING |
| — REPAIR | RING |
| — INSTALLATION EASE | ETHER, CATV |
| — RELIABILITY | ETHER |
| SCALE MAXIMUM | |
| — DISTANCE VS. SPEED TRADEOFF WITH CONTENTION | RING |
| FUTURE USE OF OPTICS | |
| — BROADCAST OPTICS ENERGETICS | RING |
| — SPEED | RING |

## CONCLUSIONS

1. RING PROBABLY HAS SLIGHT TECHNICAL EDGE

2. THE REAL APPLICATION FOR ETHERNET CSMA/CD IS ON COMMUNITY CABLE!

3. TECHNICAL DIFFERENCES OVERWHELMED BY MARKETING. CHOOSE BY AVAILABILITY -- THEY ALL WORK!