

## IBM-LASL Meeting

agenda

## STRETCH Meeting

May 9, 1957

- (1) Gen. Progress Report
- (2) Review Exchange
- (3) Progressing & recent.
- (4) Ram. Exchange coop.
- (5) I/O computer
- (6) algebraic flow diag.

Last Names

Carlson  
Fink  
Woods  
Kolodny  
Worlton  
Cherry  
Blundett  
Goldstein

IBM

Dunwell  
Sarahan  
Johnson  
Buchalter  
Herb Wild  
Jack Gibson

general report (Dunwell)

Transistors      } packaging  
packaging      } ventilation  
ventilation      } Engg. progress largely "submerged".

Memory: data-flow models (bench models) ~ Sept 1 scheduled, close to conclusion now on  
 $\frac{1}{2}$  pelt mona  $\rightarrow$  3-hole device. main task is driver transistors (<sup>(NPN)</sup>) are now  
using tubes.  $\rightarrow$  driver transistors - have made exp. models. but

Transistors: (1) diffusion process is hard to control (2) measuring crystals to start with,  
"lucky crystals",

Time Sequence: (1) PNP, (2) NPN Switching, (3) NPN Drivers

working here now feel confident

Circuits: orig sched. Transistor circs. ~ Dec 57. July 57 seems to be possible now)  
standards are set to take into account "aging" & deviations of components.  
packaging, have checked sizable units at 10 Mpc.

Driving transistors act at 32 as a body. ~ in 60 to 90 days  
can describe hole memory. may want to make boxes larger. ← NOTE

Future Plan: Toroid cores. awaiting drivers

Exchange: near final freezing. should be running next year.

Bus system: making bench tests. not specific to particular machine. 2 methods are being considered now (Pomerine - asymmetric apn. ) ~60 days

adder: have 10 MP adder, switching & registers are planned for July 1.

I/O units: (take up later with Exchange)

Bu Shys: <sup>(1)</sup> support on Mem Units, <sup>(2)</sup> planning on their type of work,

Planning Groups specified 20 problems for future

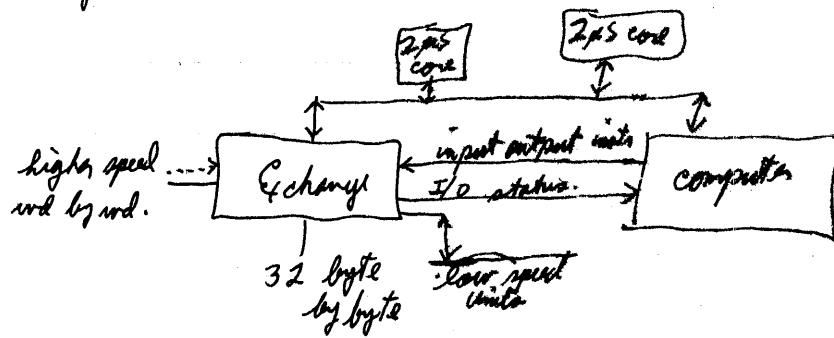
IBM <sup>has</sup> given them a manual on machine. question of who owns it --

Basic Computer which can be changed to fit a variety of jobs.

- Exchange - memory - I/O - etc. - so or not to do 3 indep. systems.

1. cost decision to get machine. word questions.
2. Delivery
3. how fast will it work, performance.
4. auto prog system.
5. reliability.

Exchange (Herb Wild)



Medium : 30 kc.

High speed : 30 words sec

Control wd

Data Wd address 20	Next control wd add. 20	wd.count 15	Status 7 [111]
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(inhibit  
not used error condition?)

(Bucholtz)

Instructions for Exchange:

Read }  
Write }

Locate  
control  
Disconnect

Control Wd add. 20	Yo unit add. 18	Disk add 12	open etc.
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Programmer should be able to think of each unit as separate - Exchange is prime limit of 32 units (10 channels) if more are asked for - delay.

Select: computer waits for click whether unit is already selected before continuing.  
REWind } a channel isn't assigned until unit says it is  
Read } no longer busy.

Locate: to send addressing info. to I/O unit. e.g. track or block on disk  
words for plotting.

Control: rewind, backspace, turn on/lit, etc. I/O unit decodes field (1st 8 bits)

Disconnect: "Safety valve" instr. cancels out order in exchange. to free channel.  
can program it to query to see if we are where we want to be.

(1) Signals which are forced on

(2) Signals programmed interruption

## Program Interrupts:

conditions.	(1) Exchange cannot accept info.	Select Request	} come back immediately sets all transfer bits (unless masked out)
		Not ready reject.	
	(2) any unit can give, (identify unit is carried along)	Normal End.	
	These will be stored away - can be interrogated any time. (They come back at odd times)	Operator Signal (defined by program)	
		End of File	
		Cancel	
		Data Error	
			} soft interruptable by auto conv. device. e.g. keyboard among key struck

## Interrogate:

256 - 511 I/O addrs.

can also be used as data word.

Unit Status 7 bits : assign channel

data error

not ready

Select for read

Select for write

Select for locate

Select for control

77 bits total  
here.

1 bit interrupt bit (used by EXChange)

## Scanning of Exchange:

- (1) channel scanner, (top priority)
- (2) instruction scan
- (3) memory scan

grouping + distribution ?

questions:

1. stepping by other than 1, ( $\pm \Delta$ )
2. read backwards?
3. automatic retry? better to

## (Buchholz) I/O Units

1. Card Reader  $\sim 1000$  cards/min

2 reading stations read & compare before sending to computer.

10 bytes of 8 each 12 times for card,

$\therefore$  card image: 15 words 960 bits

I/O computer can rearrange card image?

2. Card Punch  $\sim 155$  cards/min

2 punching stations, 1 reading station (good for new cards only)  
960 bits, card image.

3. Mechanical Printer: 500 line/min wire printer at present (1200 line/min)  
hope to make it 1000 or more later. Same as  
720 wire printer.

4. Tape Units: 727 type (15,000. bit characters/sec.)  
 $\sim 24$

are handled as 8 bit bytes  $xxxxxx00$

may later take  $\overbrace{=}^6 \overbrace{=}^8$   
(compacting)

points  $\begin{array}{r} 1 \\ 2 \\ 3 \\ + \\ 5 \\ \hline \end{array} \begin{array}{r} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ \hline \end{array} \begin{array}{r} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ \hline \end{array} \begin{array}{r} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ \hline \end{array} \begin{array}{r} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ \hline \end{array} \begin{array}{r} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ \hline \end{array} \begin{array}{r} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ \hline \end{array} \begin{array}{r} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ \hline \end{array} \begin{array}{r} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ \hline \end{array} \begin{array}{r} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ \hline \end{array} \end{array}$

159  
726 10  
39 11  
+ 8 12  

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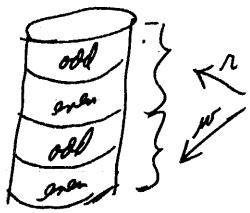
 $\begin{array}{r} 4 \\ 3 \\ 2 \\ 1 \\ \end{array}$

5. Inquiry station

Keyboard, typewriter, console 500. + lines

(Punch, Read off, Program load.  
not part of console)

Disk: (Farnell)



4 active sections, 1 set of arms for each, (either read  
about 18 arms each or write)  
4 words  
with 18 get 72 bits in 4 successive bit times.

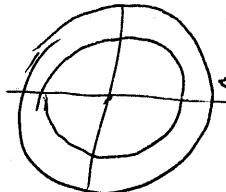
capacity 4 million words

1 word / 88  $\mu$ s

read and write

1 word read and write 1 word in 8  $\mu$ s

e.g. read in section 1, write in sect 2  
(or vice versa)



256 tracks

4,096 words per track on 18 tracks,

go on ~~track~~ at beginning of a block only

present thinking: 1024 words is 1 block length.

18,000 rpm

32 msec per rev.

30,000 rpm

Time between tracks less than one rev.

Data use

Rough

June 12, 13 Wed. Thurs

- 1. division of engg. sections  
labor estimation  
2. problems for examination  
in detail

Fri, M

Discussion of large 3D prob.

$$\text{Timing} \quad (300 \text{ adas/pt}) (1 \times 10^6 \text{ sec/ada}) (2 \times 10^5 \text{ pts}) = 60 \text{ sec}$$

$$\text{disk} \quad (2.0 \times 10^6 \text{ orders}) \cancel{(1000)} (8 \mu\text{s/order}) = 16 \text{ sec}$$

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$$\phi' = \phi_{\text{old}} + w \left( \sum C_i \phi_i + S - \phi_{\text{old}} \right) \quad \text{Reactor Eq.}$$

~18 μs

$\phi_{\text{old}}$       7 quarters  
C.i., S

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Eqt. Implicit eq:

$$\dot{R}^{n+1} = \ddot{R} \Delta t = \dot{R}^n$$

Doublit.

$$\dot{R}^{n+1} = \frac{\ddot{R}^n + \ddot{R}^{n+1}}{2} \Delta t + \dot{R}^n$$

$$R^{n+1} = R^n + \frac{\dot{R}^n + \dot{R}^{n+1}}{2} \Delta t - \frac{\ddot{R}^n - \ddot{R}^{n+1}}{2} \Delta t^2$$

## Nearest Neighbors Calc. Training.

1. Basic eqs. (conservation laws) two cycles { ~~mass-momentum~~ I  $C_I$   
energy-trans. II  $C_{II}$
  2. neighbor

I.  $\begin{cases} \text{- neighbor tape (call in one by one)} \\ \text{- call in block containing PS for } m \text{ points} \rightarrow \text{Storage: } \leftarrow (\text{no. neighbors}) \\ \text{- go thru External mem call in neighbor quantities for } m \text{ points} \end{cases}$

At home

$n = \text{main block}$

$m$  = no. advanced at a time - calc mass & momentum eqs. for  $m$  pts

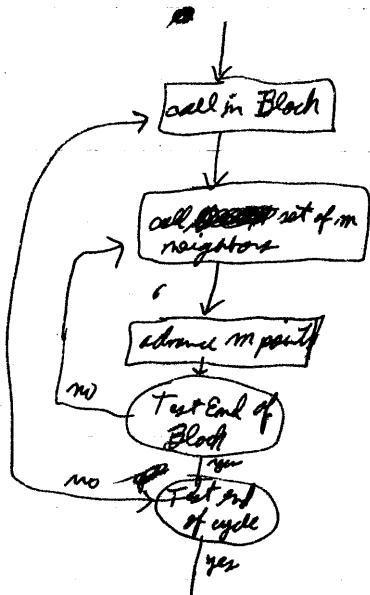
$$m < n$$

but an integral  
multiple

### Tests to repeat

time : m C<sub>I</sub>

Storage: code I ~~Other~~



Total Time:

$$\begin{aligned}
 & \frac{N}{m} (1 \text{ disk time } -) \quad \text{readin of P.S.} \\
 + & \frac{N}{m} (1 \text{ disk time }) \left( \frac{N}{m} - 1 \right) \quad \text{call in neighbors} \\
 + & NC
 \end{aligned}$$

$$\boxed{\begin{aligned} & \text{(Eq)} N = 10^4, \text{ dist min} = \cancel{0.000}, 3 \times 10^{-2} \text{ m} \\ & n = 10^3, m = 10^2, CI = 3 \times 10^{-4} \text{ m} \end{aligned}}$$

$$10(3 \times 10^{-2}) + 10^2(3 \times 10^{-2})(10^{-1}) + 3.0 = 30.3 \text{ sec}$$

## II. - call in block stage in, the (1st.)

- calc energy Thermo. struc: calc & time  $mC_2$

-repeat for each block

1

$$\text{totalTime: } \frac{N}{n} \text{ (1 distinction)}$$

$$+ C_{\text{II}} N \quad C_{\text{II}} = 3 \times 10^{-4}$$

$$10(3 \times 10^{-2}) + \cancel{3.0} = 3.3 \text{ sec}$$

$$\text{Total for cycle : } 9.6 \text{ sec} \quad \left\{ \begin{array}{l} \text{at } 0 = 30.3 \text{ m} \\ \text{at } 6 = 6.0 \text{ m} \end{array} \right.$$

## Neighor Search:

- make pass over manipulation is 5% Time: 1 disk rev.

### I. Form graph

Storage:  $N$

- Sort on ~~velocity~~ &  $n$  comparing to previous 5%

(1 rev. time) Time:

$N_s$  = no of graph nodes. - call in graph section :  $l$  nodes Storage

$l$  = no of sections - call in code from 59. & PW<sub>2</sub> Time & (rev. time)

### II. list neighbors.

call in graph section.

Time: 1 rev.

write part of neighbor block  
calculate rings

Storage:  $l$

Time: 1 rev.

C III

$$\text{Total Time} : \frac{N_s}{l} (\text{rev}) + \frac{N_s}{l} (\text{rev}) \frac{N}{n} + \frac{N_s}{l} (\text{rev}) + N C_{III}$$

graph



$$\text{Eg.: } N_s = 4 \times 10^4, l = 10^4, C_{III} = 10^{-4}$$

$$(4)(3 \times 10^{-2}) + (4)(10)(3 \times 10^{-2}) + (4)(6 \times 10^{-2}) + 1$$

$$.12 + 1.2 + .24 + 1 = 2.56 \text{ sec}$$

$$\text{point about} = 9.60$$

$$\text{core only occasionally} \rightarrow \text{neighor search} = \frac{2.56}{12.16 \text{ sec}}$$

discussion

interface with I/O computer + Exchange, bus system  
perhaps I/O mainly logic less lookahead 2μs/step  
H.S. ~~0.000~~ arithmetic

Next decide on organization ..

- question of a scale of "cost" tronictas, registers,  
- complexity of I/O + H.S.  
evaluate in terms of problems - auto prog.

Basic communication: Multiple computers can be hooked together ← basic principle