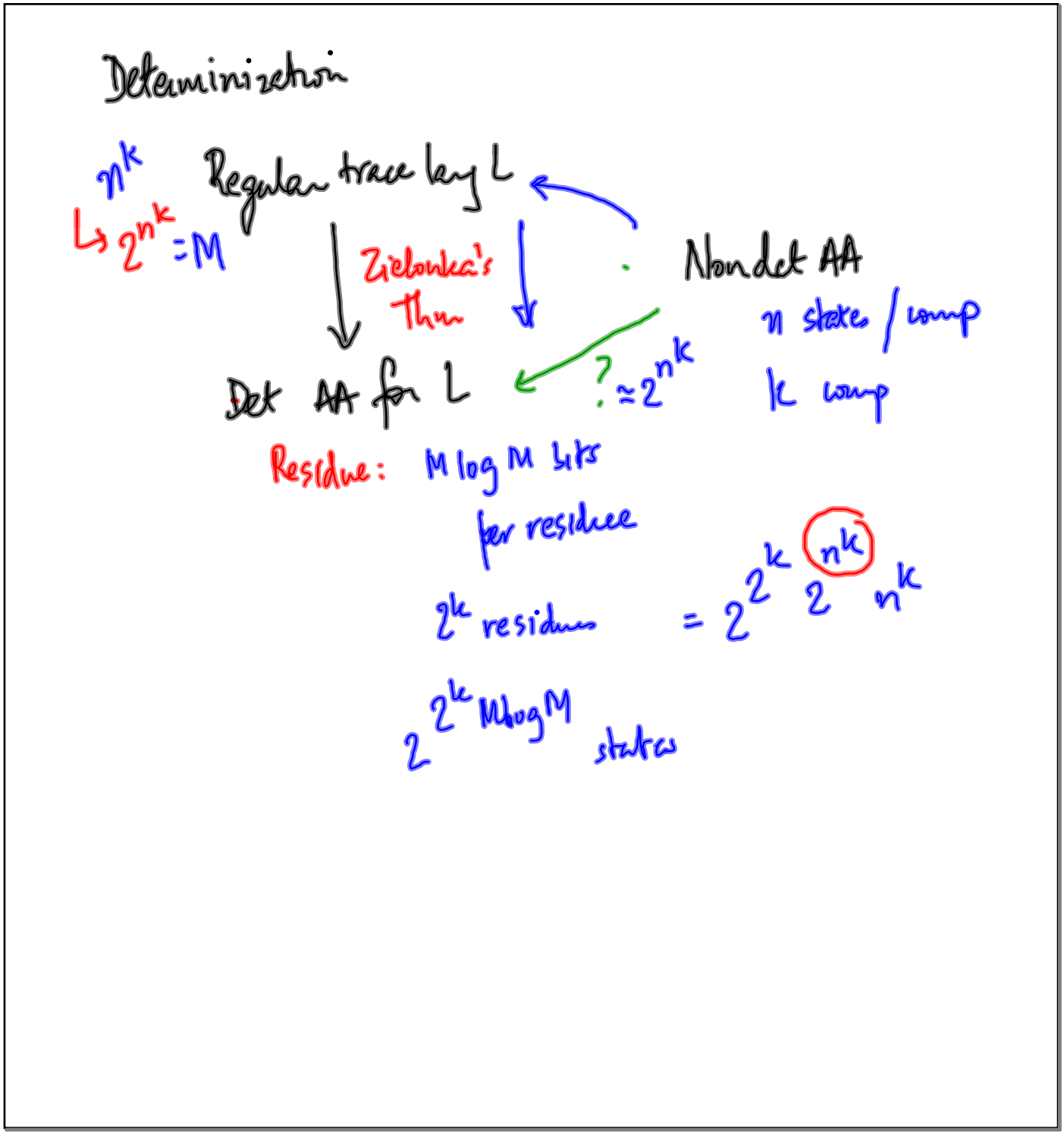
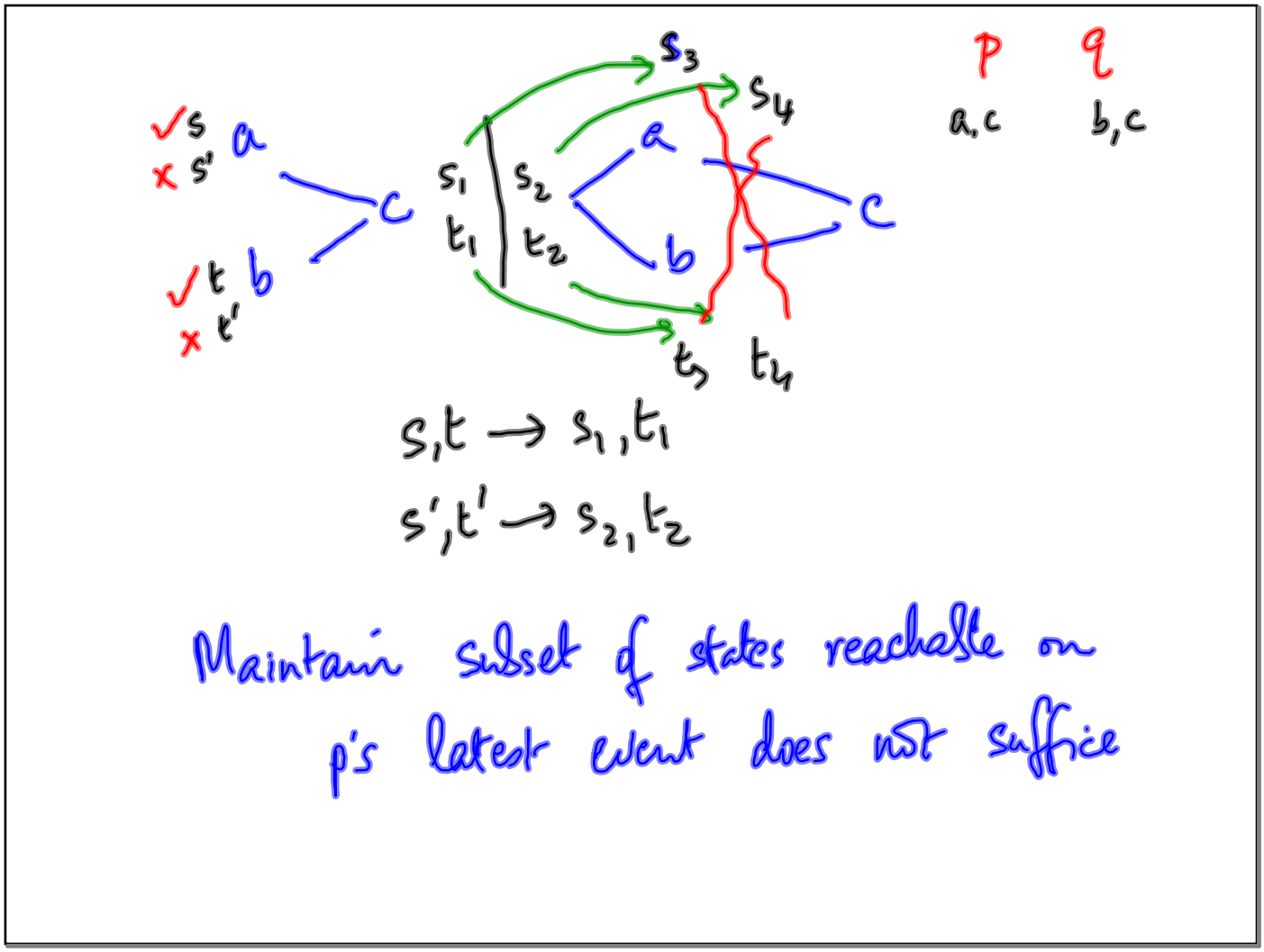
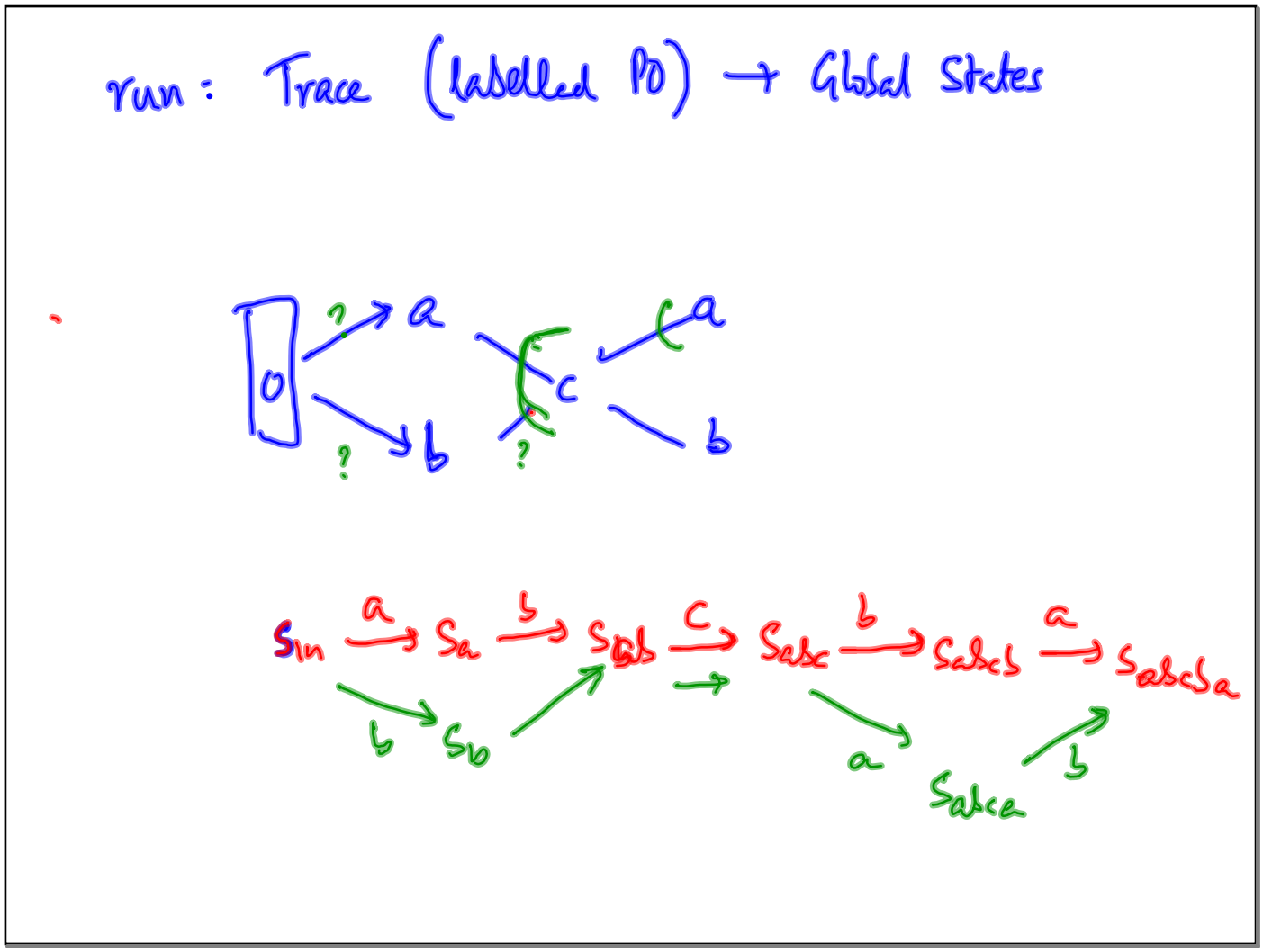
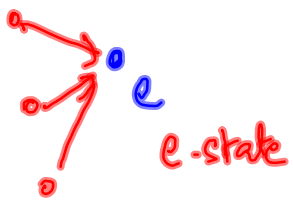

Determinization
n^k
$\hookrightarrow 2^{nk} = M$
Regular trace lang L
Zielonka's Thm
Nondet AA
n states / comp
k comp
Det AA for L
$? \simeq 2^{nk}$
Residue: M log M bits
per residue
2^k residues
$= 2^{2^k} \, 2^{nk}$
$2^{2^k} M \log M$ states


p
q
a, c
b, c
s
s'
t
t'
a
b
c
s_1
s_2
s_3
s_4
t_1
t_2
t_3
t_4
$s,t \rightarrow s_1, t_1$
$s',t' \rightarrow s_2, t_2$
Maintain subset of states reachable on p's latest event does not suffice

run : Trace (labelled PO) → Global States



An event e in my trace



$nbd(e)$ $\forall p \in loc(e)$ max p event below e

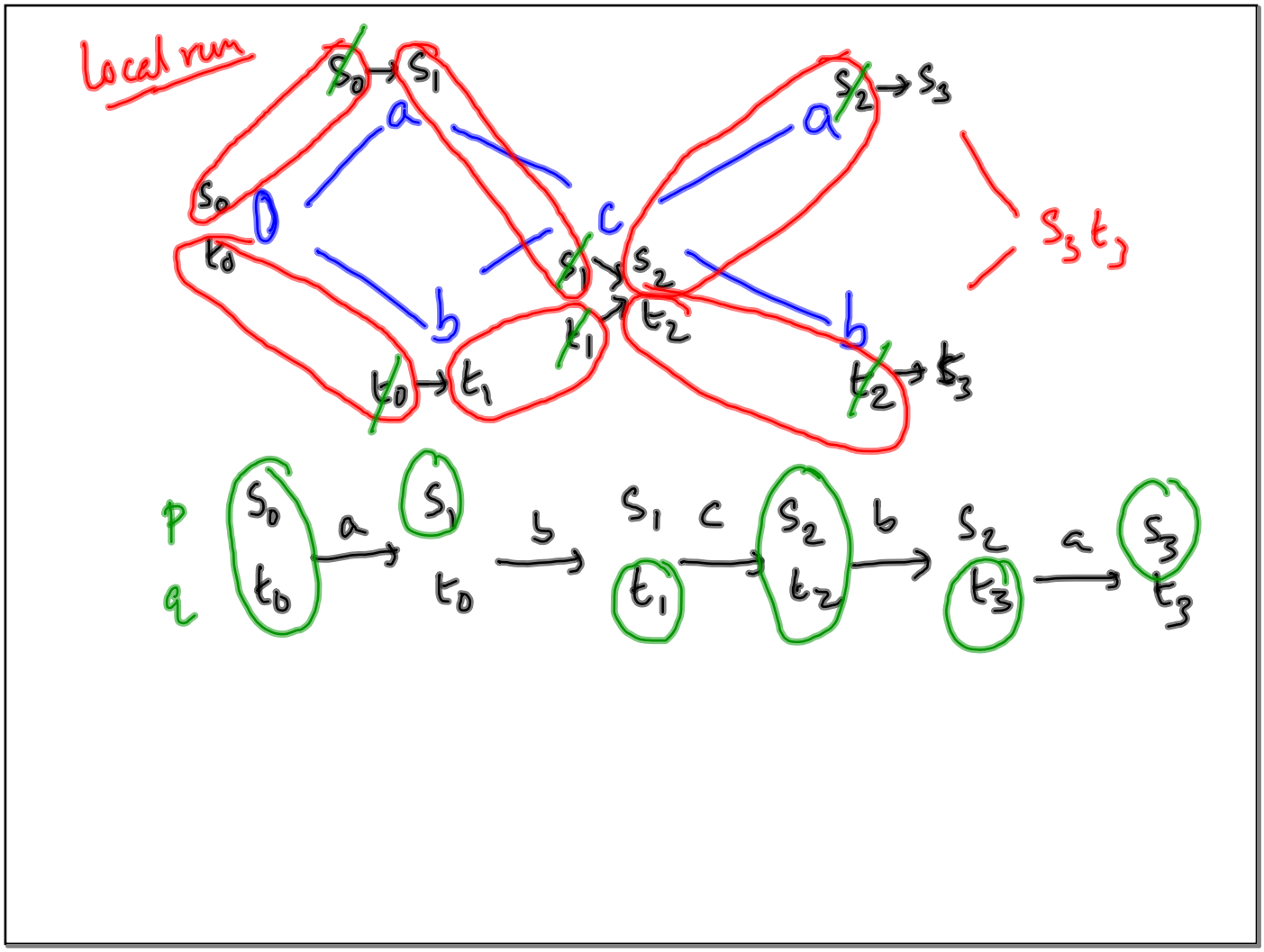
Local run :

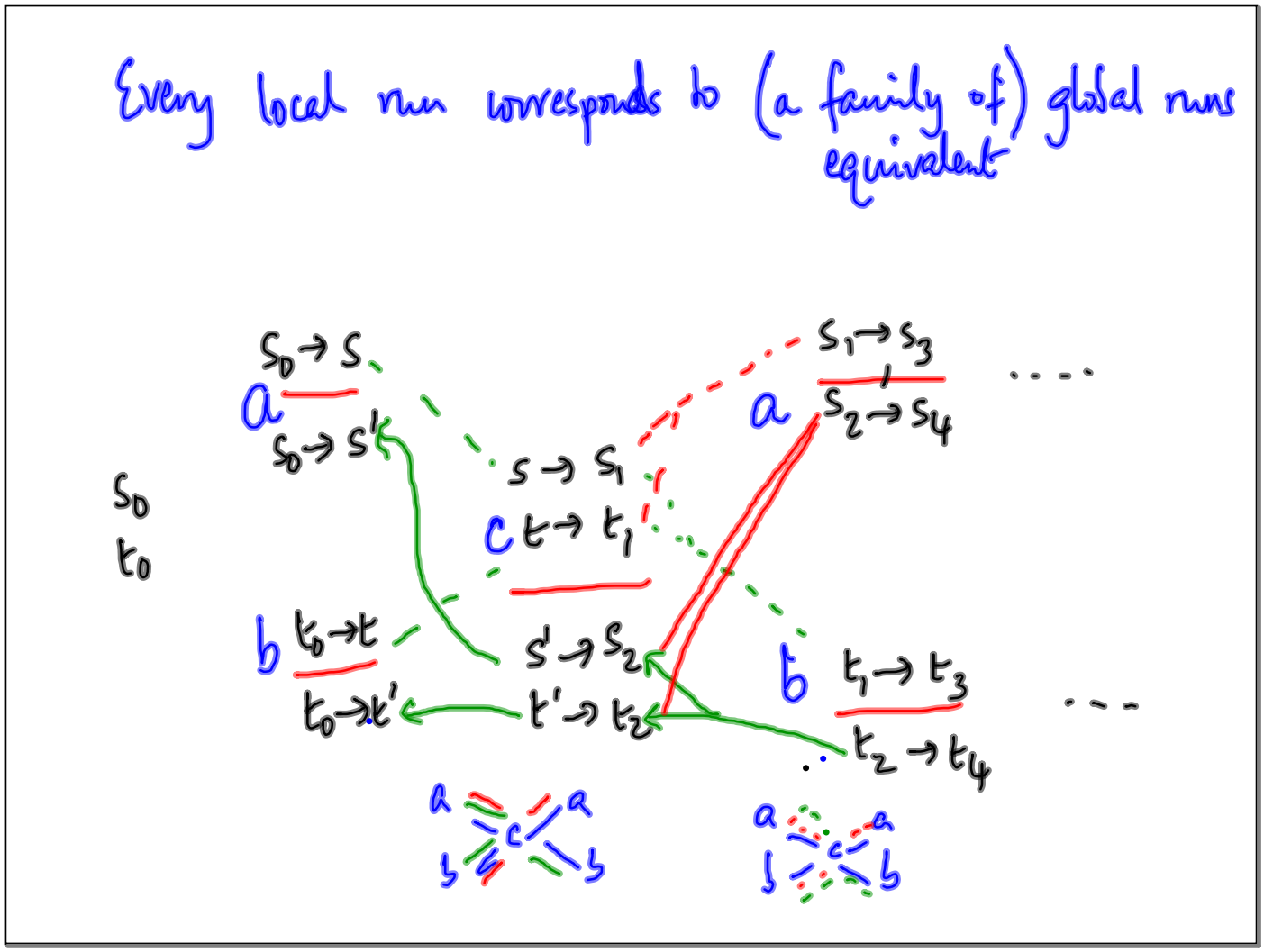
label each $nbd(e)$ as follows:

Assign e an e-state $\overline{s_e}$

Assign each p-pred of e a p-state s_p

s.t. $((s_p, s_{q_1}, -), \overline{s_e}) \in \delta_e$


local run
a
b
c
a
b
$s_3 t_3$
p
q
a
b
c
b
a


Every local run corresponds to (a family of) global runs equivalent
$s_0 \to s$
$s_0 \to s'$
$s \to s_1$
$s_1 \to s_3$
$s_2 \to s_4$
s_0
t_0
$t_0 \to t$
$t_0 \to t'$
$t \to t_1$
$s' \to s_2$
$t' \to t_2$
$t_1 \to t_3$
$t_2 \to t_4$
a
b
c

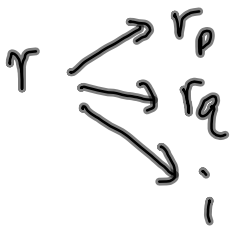
Each p maintains all possible local runs on the p-view

Local runs of $\{p, q, \ldots\}$ are compatible if $r_p, r_q, \ldots$ they agree on common events

$r_p \otimes r_q \otimes \ldots$ denotes the overall labelling derived from compatible $\{r_p, r_q, \ldots\}$

is a valid run on whole trace

"global" run r written out "locally" on a trace



project on ∂_p, ∂_q ..

$r = r_p \oplus r_q \otimes \cdots$

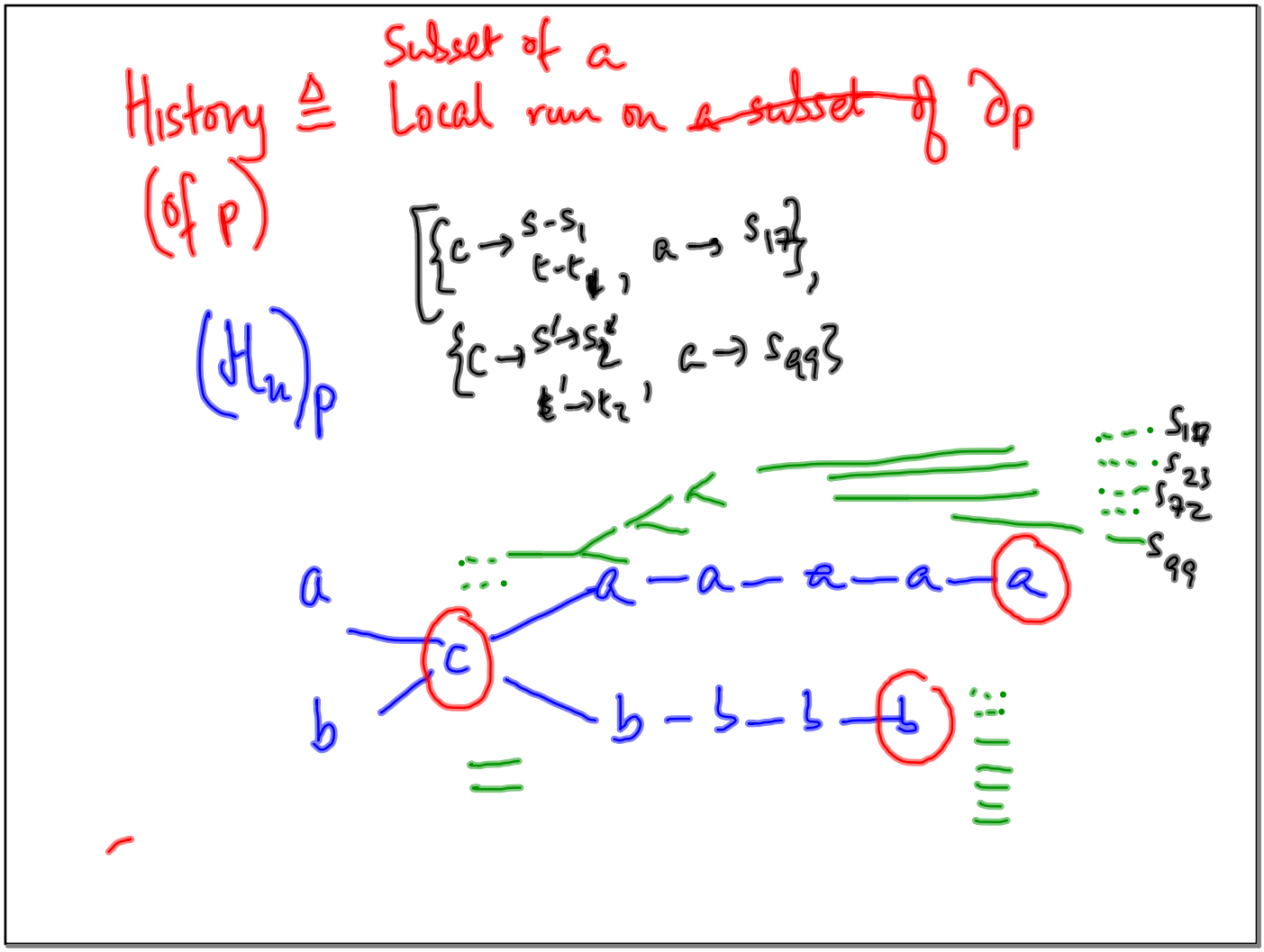
Let R_u be the set of all runs on trace u

$\forall r \in R_u \quad r = r_p \otimes r_q \otimes \cdots$

$(R_u)_p = \{r_p \mid r \in R_u\}$ $\qquad \bigotimes_p (R_u)_p$

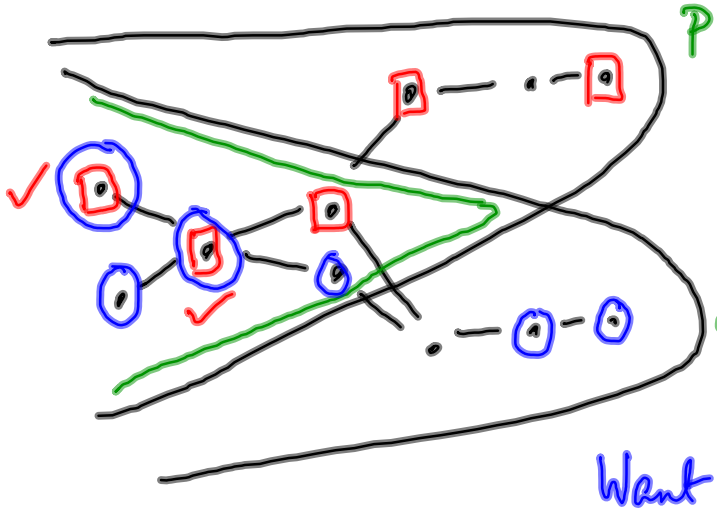
$$R_u = \bigotimes_p (R_u)_p$$

Maintain a bounded subset of $(R_u)_p$ in each p


Subset of a
History ≜ Local run on ~~a subset of~~ ∂p
(of p)
$(H_n)_p$
s_{17}
s_{23}
s_{72}
s_{99}
a
b
c

Two histories are compatible if they agree on common (remembered) events

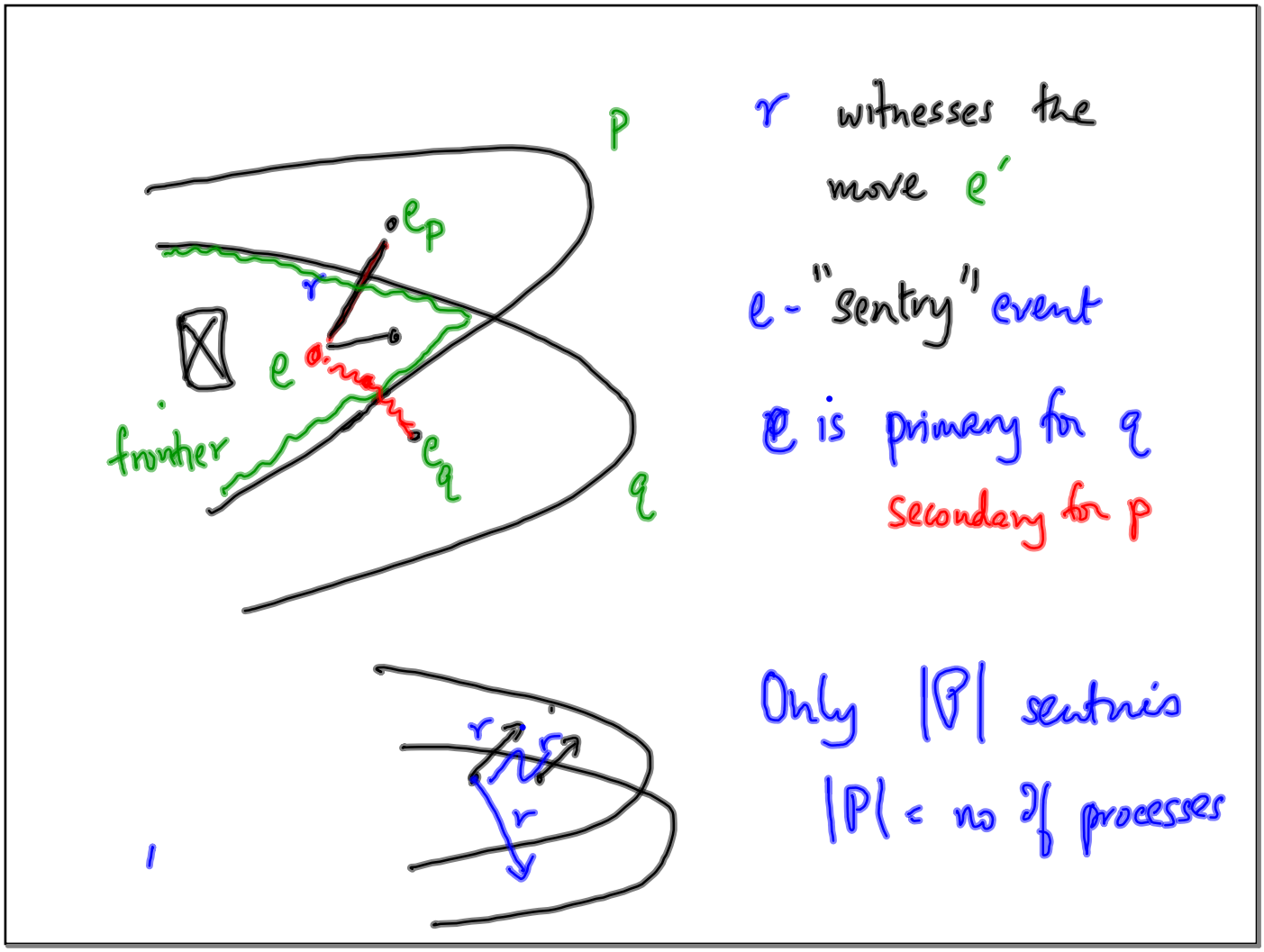
When does compatibility extend to runs?



h_p arises from reachable r_p

h_q arises from r'_q

Want $h_p \otimes h_q$ to arise from r''



Madhavan Mukund

Basic gossip labels events consistently upto primary

l does not appear in secondary$_p$

$\Rightarrow$ l does not appear as primary label for $q \neq p$

secondary $\rightarrow$ tertiary

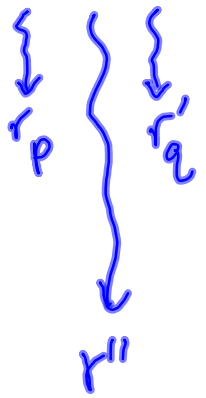
l does not appear in tertiary$_p$

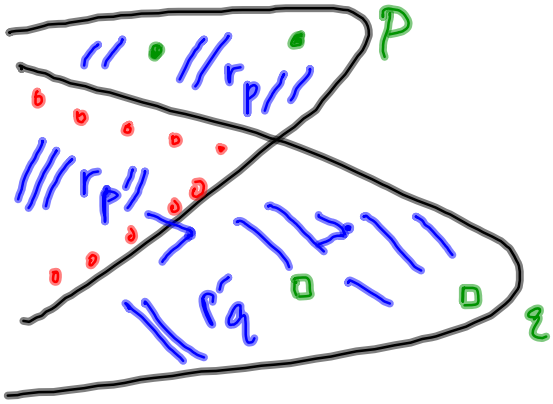
$\Rightarrow$ l does not appear as secondary label for any other q

Maintain history upto primary + secondary

⇒ all sentries are covered, as also max_p

$h_p \otimes h'_q$ s.t. h_p & h'_q are upto prim+sec





- Each p maintains histories over prim + sec
  - When e occurs
    - Combine all compatible histories from loc(e)
      - For each compatible history
        - Extend by a valid move for e
        - Project to new prim + sec

some history collapse

History: Pair of labels → Global states

n^k

$A \to B$

$k^2 \cdot 2 \cdot k \log n$ bits to write a single history

histories = # bits to write local state

$n^{k \cdot 2k \log n} \cdot k^2 \cdot 2k \log n$

$2^{n^{k^3} \cdot k^2 \cdot 2k \log n}$ states

Lower bound

$n^k \rightarrow 2^{(n^k)/k}$

2^{n^k} global states

At least one component has $\sqrt[k]{2^{n^k}}$ local states