# Token Based Algorithms

## II Singhal's Heuristic Algo

- called heuristic because sites are heuristically selected for sending token request messages.
- each site maintains information about the state of other sites in the system & uses it to select a sites that are likely to have the token.
- When token request messages are sent only to a subset of sites, it is necessary that a requesting site sends a request message to a site that either holds the token or is going to obtain the token in near future.

### DATA structure

2 arrays

$SV_i[1....N]$ = store the state

$SN_i[1....N]$ = highest known sequence number for each site.

Token has 2 arrays

TSV [1....N] & TSN [1....N]

Sequence Numbers are used to detect outdated requests.

R - requesting the CS

E - executing the CS

H - Holding the idle token.

N - none of the above.

## The Algo

1. Requesting the CS.

a) If requesting site does not have the token, then

It sets $SV_i[i] := R$

It increments $SN_i[i] := SN_i[i] + 1$

It sends REQUEST $(i, sn)$ message to all sites $S_j$ for which $SV_i[j] = R$ ($sn$ is the updated value of $SN_i[i]$).

b) When a site $S_j$ receives the REQUEST $(i, sn)$ message, it discards the message if $SN_j[i] \geq sn$ because message is outdated.

Else it sets $SN_j[i]$ to '$sn$' & takes the following actions based on its own state:

- $SV_j[j] = N$ : Set $SV_j[i] = R$
- $SV_j[j] = R$ : If $SV_j[i] \neq R$ then set $SV_j[i] = R$ & send REQUEST $(j, SN_j[j])$ messages to $S_i$ (else nothing)
- $SV_j[j] = E$ : Set $SV_j[i] = R$
- $SV_j[j] = H$ : Set $SV_j[i] = R$, $TSV[i] = R$, $TSN[i] = sn$, $SV_j[j] = N$, send the token to the site $S_i$.

2. Executing the CS

$S_i$ executes the CS after it has received the token. Before entering the CS, $S_i$ sets $SV_i[i]$ to E.

## Releasing the CS

After finishing execution site $S_i$ sets $SV_i[i] := N$ & $TSV[i] = N$ & updates its local & token vectors in following way

For all $S_j$, $j = 1$ to $N$ do

if $SN_i[j] > TSN[j]$

then update token info from local info

$\{ TSV[j] := SV_i[j] ; TSN[j] = SN_i[j] \}$

else update local info from token info.

$\{ SV_i[j] = TSV[j] ; SN_i[j] = TSN[j] \}$

- If $(\forall j :: SV_i[j] = N)$, then set $SV_i[i] := H$