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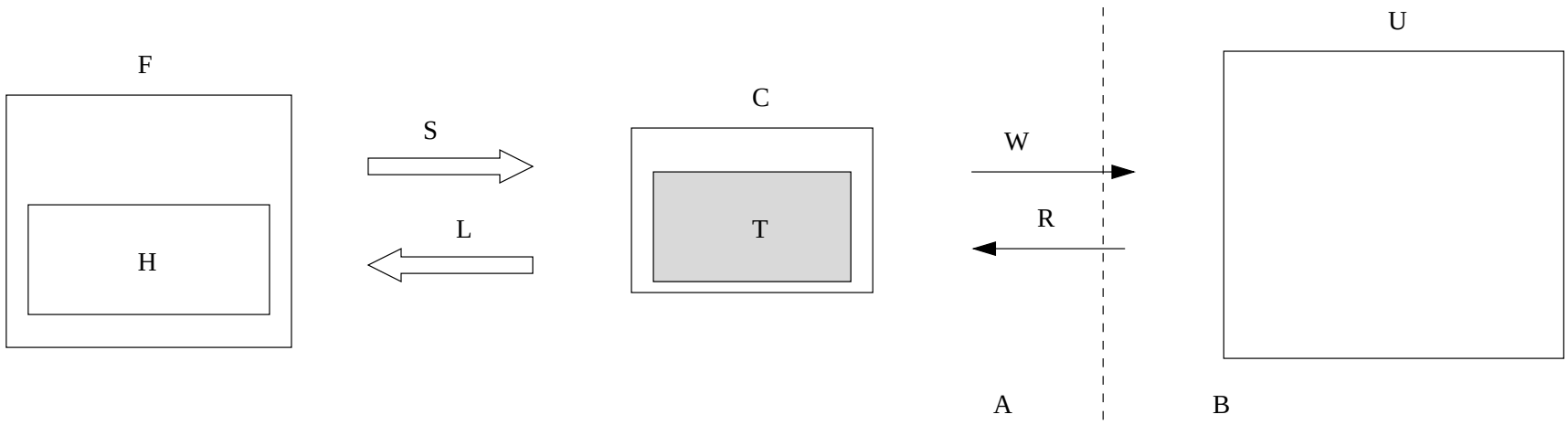
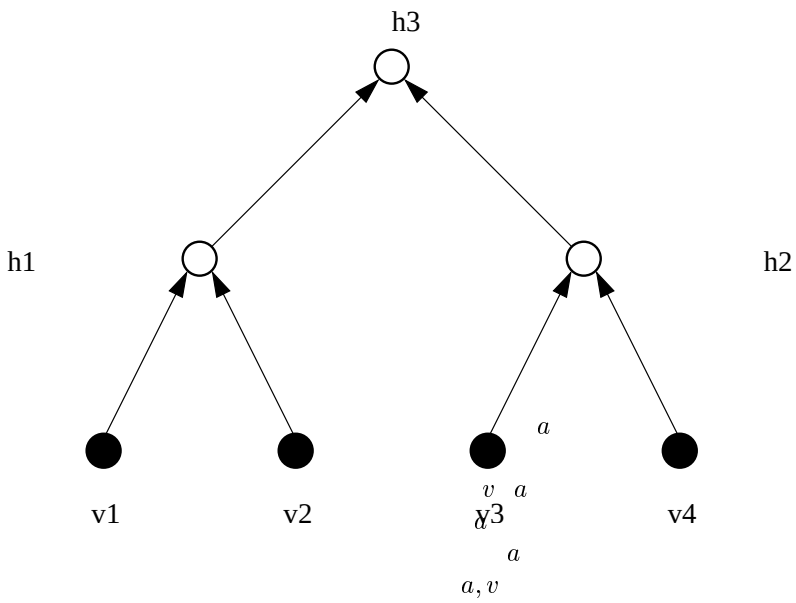

F
H
S
L
C
T
W
R
A
U
B


h3
h1
h2
a
v a
v1
v2
v3
v4
a
a, v

$\mathcal{H}(\emptyset)$

(a, v) v a

t (v, t) a

$+_{\mathcal{H}}\ a, v, t$

(a) a

(v, t) a

$+_{\mathcal{H}}\ a, v, t$

$t + 1$

(a, v) (a, v)

(a, v) (a) (a, v)

(a) v (a) v (a, v)

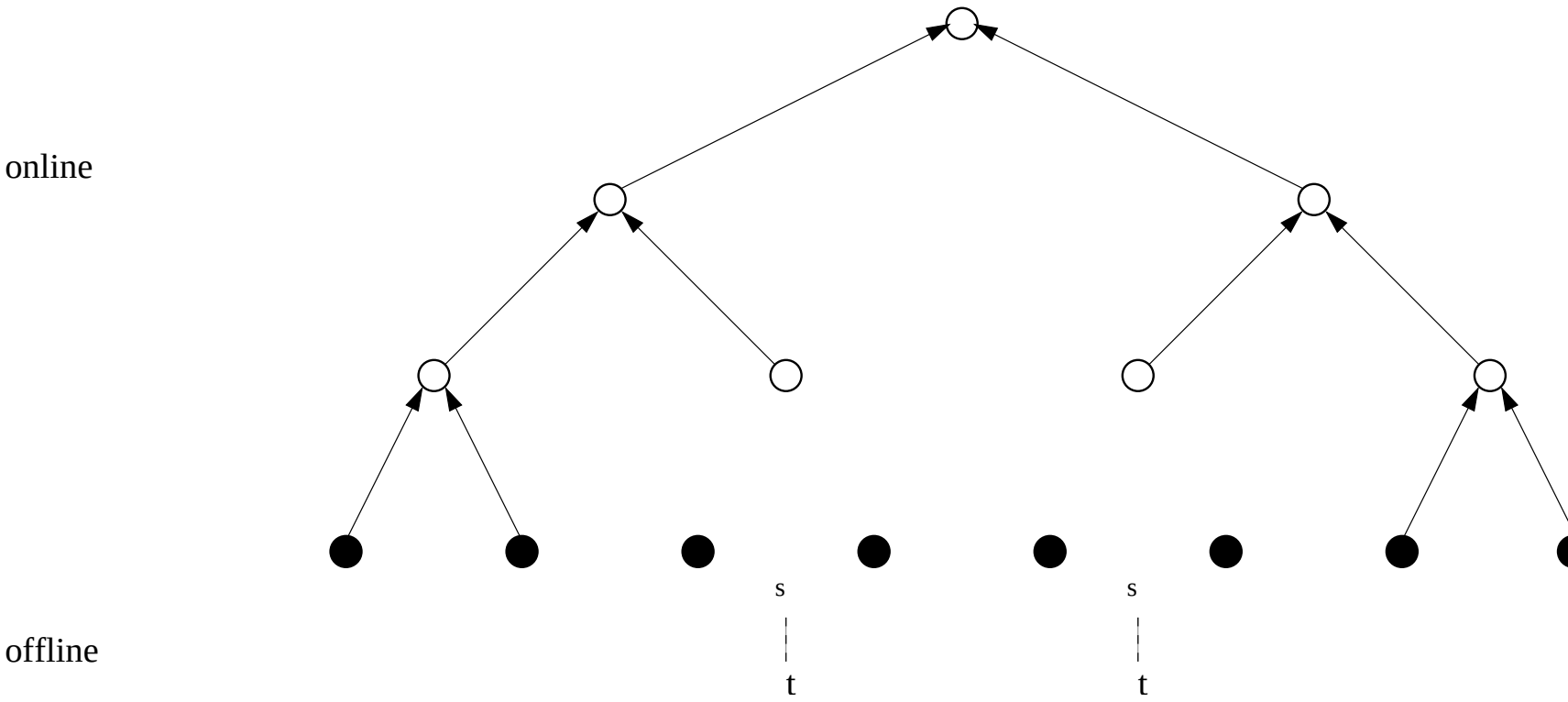
()

(a) a

()

$+_{\mathcal{H}}$ a, v, t

$(a, 0)$



Y

$\emptyset$

$\emptyset$

$a, v \quad a$

$(a, v) \;\; a$

$a \qquad v \quad a$

a

a

$a \qquad a$

$a, v \qquad a$

v

Y

Y

(a, v) v a

a a, v (a, v)

(a) a

a a (a)

(a) a

v a

a

(a, v)

(Y)

Y

()

a v a

$a \in Y$ a, v (a, v)

Y

ΔR b_t
b_b h

	$\Delta R = \omega * (2hb_b - b_b)$
	$\Delta R = \omega * (h-1)b_b$
	$\Delta R = 2hb_b - (2(b_b + b_t)) + \omega * (2hb_b - b_b)$
	$\Delta R = hb_b - (b_b + 2b_t) + \omega * (h-1)b_b$
	$\Delta R = -(hb_b + (h-1)b_b + b_t)$
	$\Delta R = -n_{lh}((b_b + b_t) \ + \ 2(h-1)b_b)$

(a, v)
(a) $()$

ω
$\omega \ = \ 0.1$

R
n_{lh}
$R = (1 + \omega)B_{ht} - B_{tl} \ \ B_{tl}$
B_{ht}

R

B_{ht}

$R \ \ n_{lh}$
n_{lh}

(a, v)

$a \quad R \quad > C \qquad + C \qquad (n_{lh} + 1)\ (a)$

(a, v)

(a)

$a \quad R \quad > C \qquad + C \qquad (n_{lh} + 1)\ (a)$

(a)

()

$Z \qquad (Z)$

R

R

- R

$(1 + \omega)B_{ht}$

$R \quad \omega$

ω

- R

C

$\Delta R = -C$

ω

- R

$C \qquad (n_{lh})$

$C \qquad (n_{lh}) \quad n_{lh}$

$\Delta R = -C \qquad (n_{lh})$

R

R

$R \ > \ C \qquad + \ C \qquad (n_{lh} + 1)$

R

n_{lh}

R

$R \quad R$

$R \qquad R$

$R \qquad\qquad R$
$R \quad = R - R \qquad\qquad R$

$B_{tl} \quad B_{ht}$

||

||

||

(a, v)

a
R' $>$ C $+$ C $(n_{lh}+1)$ $+$ C $(n_{lh}+1)$
(a)
$R + \Delta R$ $< C$ (n_{lh})

(a, v)

- R
  $\Delta R \geq -C$ (n_{lh})

ΔR C
C (n_{lh})
C (n_{lh})
R

C (n_{lh}) $=$ C (0) $+$
C (n_{lh}) C (0)
n_{lh} C (n_{lh})
n_{lh} C (n_{lh}) $=$
C $(n_{lh}) + C$

R

R' R'
R $>$ C (0)

n_{lh}
C (n_{lh}) $=$ C (n_{lh}) $+ C$

R

- R
  ΔR R
  ΔR

  $\Delta R = \Delta R$
- R
  $\Delta R = -C$
- R
  $\Delta R \geq -C$ (n_{lh})

R $>$ C (0) R' $=$
R $-$ $(C$ (0), R $)$ R
R
R
R'
R C (0)

C (n_{lh})

$$R' \quad R > R' \quad + C \qquad (0)$$

$$R' \quad > (C \qquad + C \qquad (n_{ih} + 1) + C \qquad (n_{ih} + 1)) \quad R \quad > (C \qquad + C \qquad (n_{ih} + 1) + C \qquad (n_{ih} + 1)) + C \quad (n_{ih}) \; R > (C \qquad + C \qquad (n_{ih} + 1) + C \qquad (n_{ih} + 1) + C \qquad (0)+C \qquad) > (C \qquad + C \qquad (n_{ih} + 1) + C \qquad (n_{ih} + 1)) \quad R > (C \qquad (n_{ih} + 1) + C \qquad (n_{ih} + 1))$$

$$R > (C \qquad (n_{ih}) + C \qquad (n_{ih}))$$

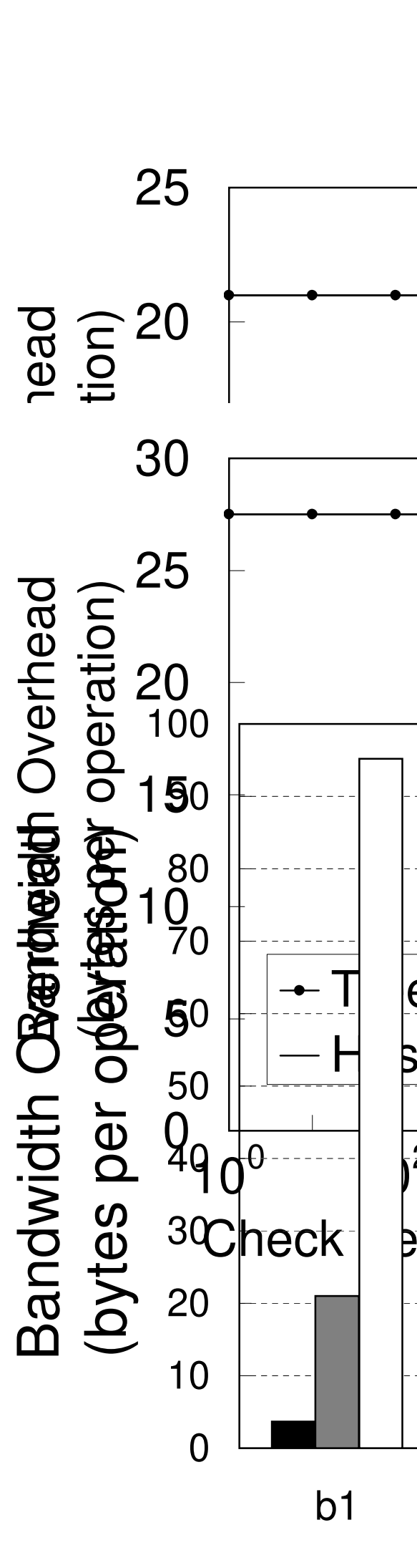
$$n_{ih}$$

$$\Delta R \qquad \omega$$

$$C \qquad (n_{ih}) \qquad 2^{14} \quad C \qquad (n_{ih}) \qquad 4hb_b n_{ih} = (4 * 10 * 64 * n_{ih})$$

$$10^3$$
$$10^4$$

$$10^7$$



36^{th}

10^6

10^3

36^{th}

b_t

b_b

n_{lh}

t

C

h_v

$(1 - h_v)$

$t(1-h_v)(2b_t)$

$(n_{lh} - C)(b_b + 2b_t)$

$t(1 - h_v)(2b_t) + (n_{lh} - C)(b_b + 2b_t)$

δh_v

$0 \leq \delta \leq 1$

z

$t(1 - h_v)b_b$

17^{th}

$t(1 -$

$\delta h_v)zb_b - t(1 - h_v)b_b = t((1 - \delta h_v)zb_b - (1 - h_v)b_b)$

$t > \frac{(n_{lh}-C)(b_b+2b_t)}{((1-\delta h_v)zb_b-(1-h_v)b_b) - (1-h_v)(2b_t)}$

n_{lh}
t

M M

M

W
R
W R

M

$W \neq R$

x_1
(v_1, t_1)
a x_1
(v_1, t_1) a $W \neq$
R
x_2
(v_1, t_1) a
a
x_1 t_1
x_1 x_2
x_2
x_1 $x_2 <$ x_1 x_3 a
x_2 x_1 x_2 $x_1 \geq x_3$ x_1
x_3
a v_1 x_1
x_1 $x_1 > x_3$
x_1
x_3 x_3
x_2

a x_3 t_1
(v_1, t_1) x_3 x_2

b_t b_b
h
C

C (n_{lh})	$2Chb_b + n_{lh}((b_b + b_t) + 2(h-1)b_b)$
C (n_{lh})	C $(n_{lh}) + 2Chb_b + Chb_b$

(v_1, t_1) a (v_1, t_1)
x_2 M

x_3 a x_2

M

(v_1, t_1) x_2
x_3 (v_1, t_1)
x_1 x_3 $W \neq R$

M
W R R W
$W \neq R$ M
$W \neq R$

■

M
M

M

a

ΔR b_t
b_b h
C
N

	$\Delta R = \omega * (2hb_b - b_b)$
	$\Delta R = \omega * (h-1)b_b$
	$\Delta R = \omega * (2hb_b - b_b) - C$
	$\Delta R = \omega * (h-1)b_b - C$
	$\Delta R = 2hb_b - (2(b_b + b_t)) + \omega * (2hb_b - b_b) - C$
	$\Delta R = hb_b - (b_b + 2b_t) + \omega * (h-1)b_b - C$
	$\Delta R = -(hb_b + (h-1)b_b + b_t) - 2C$
	$\Delta R = -n_{lh}((b_b + b_t) + 2(h-1)b_b) - 2N$

C $(n_{lh}) + 2Chb_b + Chb_b$
C (n_{lh})
$2Chb_b + Chb_b = 3Chb_b$
C C (n_{lh})

■

C (n_{lh}) C (n_{lh})

C $(0) = 2Chb_b$
C $(n_{lh}) = n_{lh}((b_b + b_t) + 2(h-1)b_b)$ C $(0) = 5Chb_b$

$2Chb_b + n_{lh}((b_b + b_t) + 2(h-1)b_b)$
$2Chb_b$

$n_{lh}((b_b + b_t) + 2(h-1)b_b)$

(a, v)

$a \quad R \quad > C \qquad + C \qquad (n_{lh} + 1)$
(a)
(a, v)

(a)

$a \quad R \quad > C \qquad + C \qquad (n_{lh} + 1)$
(a)
(a)

()

$Z \qquad (Z)$

C
$C \qquad = 64$

R
$C \qquad (0)$

R

C
$h \geq 0 \ (2hb_b - b_b) \geq (h-1)b_b$
$\omega * (h-1)b_b > C \qquad R$

$\omega = 0.1 \qquad b_b = 2^9$
$h = 12 \ \lfloor \omega * (h-1)b_b \rfloor = 563 \gg 64$

$C \qquad (n_{lh}) = C \qquad (0) + C \qquad (n_{lh})$
$C \qquad (0)$
$n_{lh} \quad C \qquad (n_{lh})$
$n_{lh} \quad C \qquad (0) = 2N$
$C \qquad (n_{lh}) = n_{lh}((b_b + b_t) + 2(h-1)b_b)$

R
$R > C \qquad (0)$
$R \quad = R - (C \qquad (0), \ R \qquad)$
$R \qquad R$

b_t b_b
h
C N

C (n_{lh})	$2Chb_b + n_{lh}((b_b + b_t) + 2(h-1)b_b) + 3N$
C (n_{lh})	C $(n_{lh}) + 2Chb_b + Chb_b$

$\omega * b_{ht} > C$
R

C (n_{lh})

C (n_{lh})
C (n_{lh})
N

$2N$
C (n_{lh}) $3N$
C (n_{lh}) $3Chb_b$
C (n_{lh}) C $(0) = 2Chb_b + 3N$
C $(n_{lh}) = n_{lh}((b_b + b_t) + 2(h-1)b_b)$ C $(0) =$
$5Chb_b + 3N$

b_{ht}

(a, v)

$\overset{a}{R} > C \qquad \overset{a}{(n_{lh})} + C$

$\overset{a}{R'} \quad > \; C \qquad\qquad + \; C \qquad (n_{lh}+1) \; + \; C \qquad (n_{lh}+1)$

(a)

$R + \Delta R \qquad < C \qquad (n_{lh})$

(a, v)