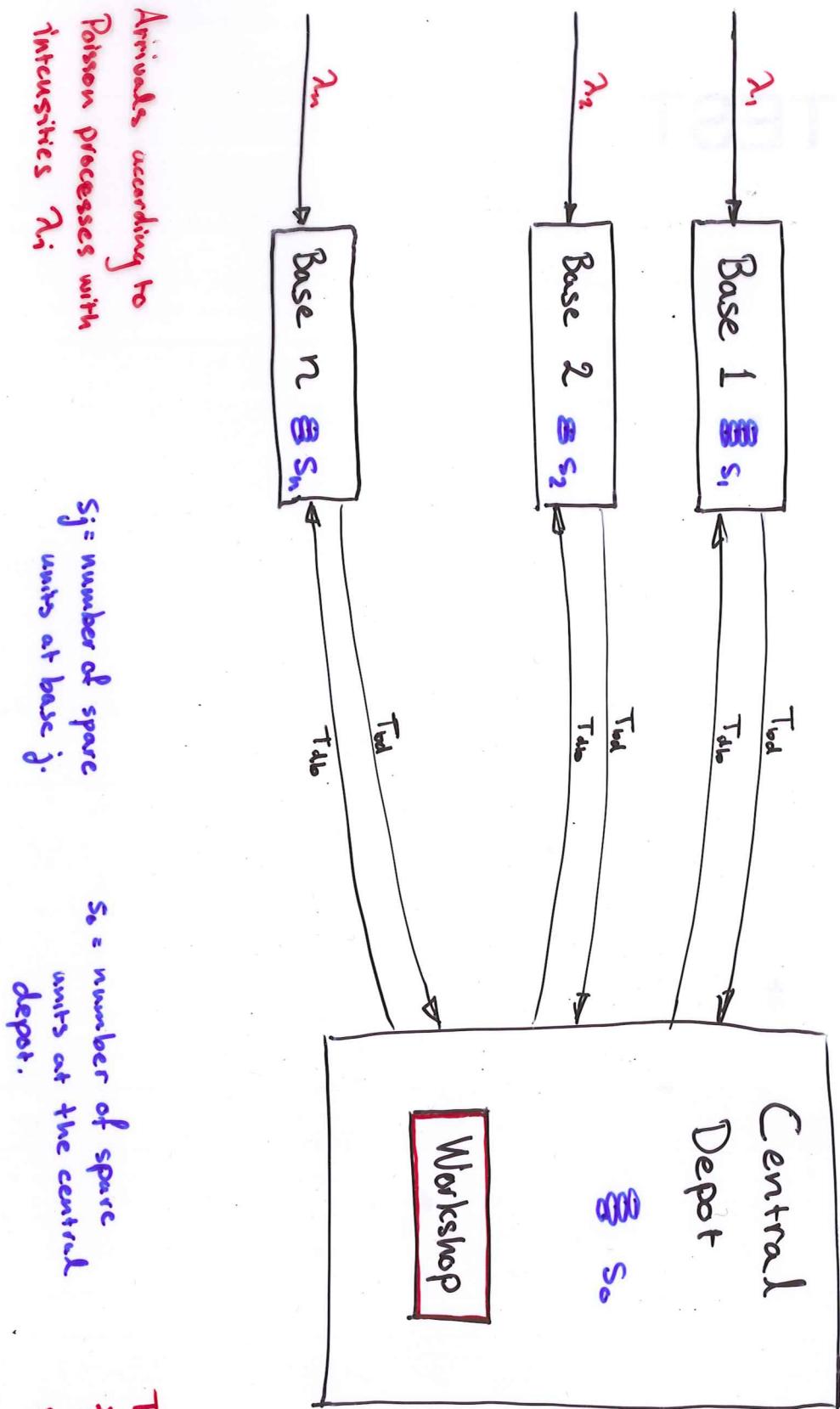


The METRIC Model



Arrives according to
Poisson processes with
intensities λ_i

s_j = number of spare
units at base j.

s_0 = number of spare
units at the central
depot.

The service time
is i.i.d. s.u.
with mean T_{rep} .

T_{bd} and T_{db} are
deterministic transport times.

Marginal Allocation for Model 3

Let $S = (s_1, s_2, \dots, s_n)^T$ = # spares at the bases

$$EBO(s_0, S) = \sum_{j=1}^n EBO_j(s_0, s_j) = \text{Average # grounded aircrafts}$$

For fixed s_0 , $EBO(s_0, S)$ is a separable integer-convex decreasing function

$$C(s_0, S) = Cs_0 + \sum_{j=1}^n Cs_j = \text{Total cost of spare units}$$

(For fixed s_0) $C(s_0, S)$ is a separable integer-convex increasing function.

Algorithm: Fix s_0 and determine $EBO_0(s_0)$ using the recursive algorithm for Model 1.

Start with $S_{s_0}^{(0)} = (0, 0, \dots, 0)^T$ (minimizing $C(s_0, S)$)

and apply the Marginal Allocation algorithm for Model 2, where

j now corresponds to base j (instead of LRU_j)

$c_j = c$ for $j = 1, 2, \dots, n$ cost for a spare unit

$T_j = T_{db} + EBO(s_0) \cdot \frac{1}{\lambda_0}$ expected pipeline times.

continued...

Let $F(s_0, k) = EBO(s_0, S_{s_0}^{(k)})$ = optimal EBO for s_0 spares at C.D. and k spares at the bases.

$$\text{Note: } C(s_0, S_{s_0}^{(k)}) = Cs_0 + \sum_{j=1}^n Cs_j^{(k)} = Cs_0 + ck$$

since one spare unit is added at each iteration

Determine, for $s_0 = 0$

$S_0^{(0)}$	$EBO(0, S_0^{(0)}) = F(0, 0)$	$C(0, S_0^{(0)}) = 0$
$S_0^{(1)}$	$EBO(0, S_0^{(1)}) = F(0, 1)$	$C(0, S_0^{(1)}) = c$
$S_0^{(2)}$	$EBO(0, S_0^{(2)}) = F(0, 2)$	$C(0, S_0^{(2)}) = 2c$
\vdots	\vdots	\vdots

for $s_0 = 1$

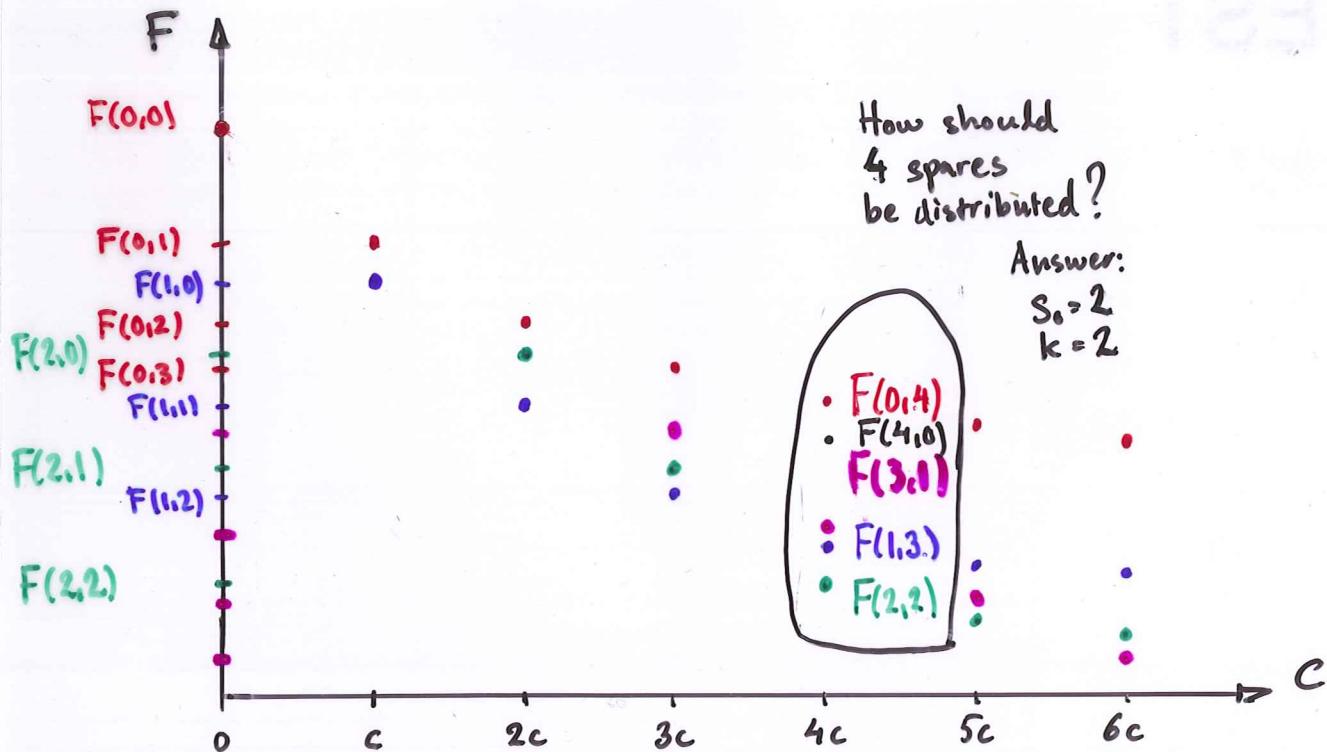
$S_1^{(0)}$	$EBO(1, S_1^{(0)}) = F(1, 0)$	$C(1, S_1^{(0)}) = c$
$S_1^{(1)}$	$EBO(1, S_1^{(1)}) = F(1, 1)$	$C(1, S_1^{(1)}) = 2c$
$S_1^{(2)}$	$EBO(1, S_1^{(2)}) = F(1, 1)$	$C(1, S_1^{(2)}) = 3c$
\vdots	\vdots	\vdots

for $s_0 = 2 \dots$

The last step is to compare $F(s_0, k)$ for different s_0 and k .

What do we do when s_0 is allowed to vary?

We compare the solutions for all choices of s_0



For each value of C compare the efficient solutions for fixed s_0 .

$$\text{Let } F(l) = \min_{s_0} \left\{ F(s_0, l - s_0) \mid 0 \leq s_0 \leq l \right\} \quad l = 0, 1, \dots$$

Then $(0, F(0))$ are the best solutions
 $(c, F(1))$ for each choice of number
 $(2c, F(2))$ of spare units
 \vdots

If the piecewise linear curve joining these points is convex it is the efficient curve for Model 3.

Otherwise, the efficient curve is obtained by generating the "southwestern" boundary of the convex hull of the points above.