



CLOUD COMPUTING CONCEPTS

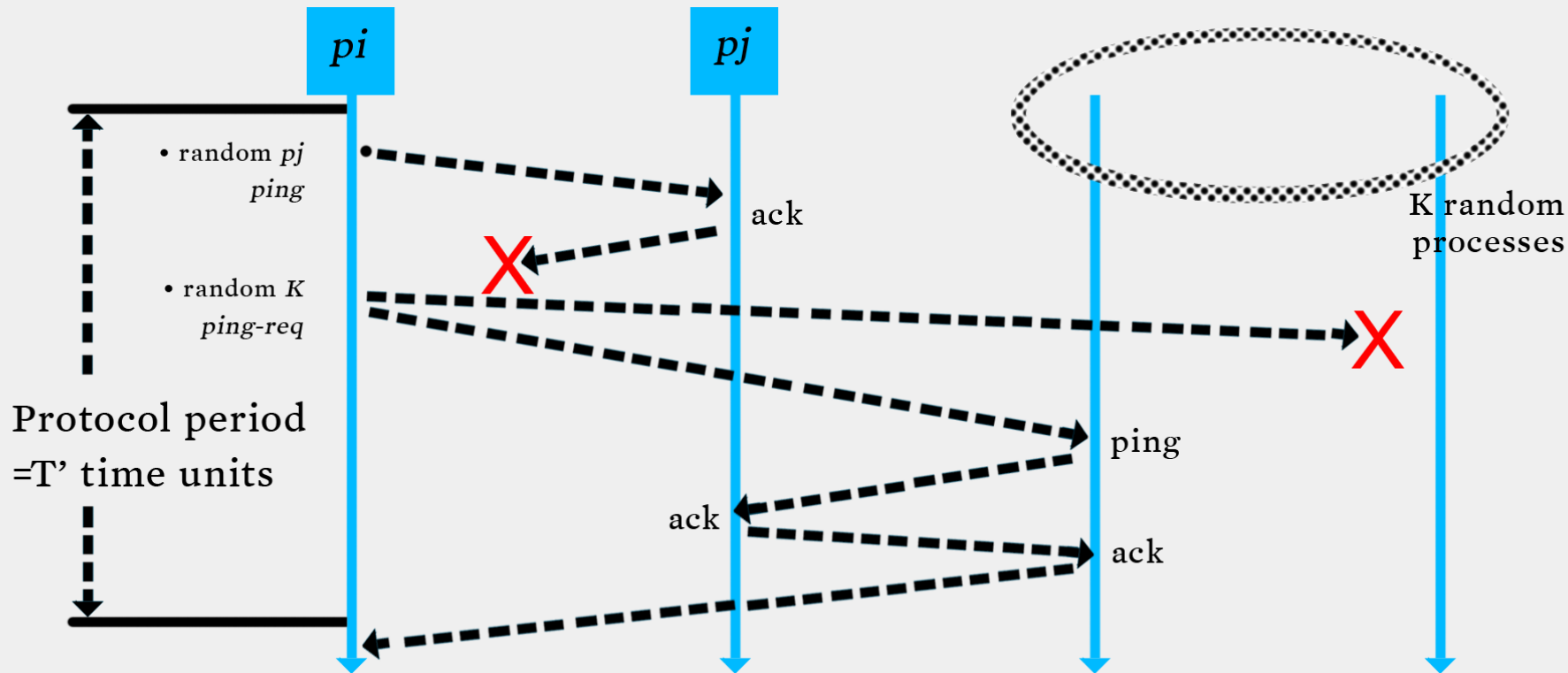
with Indranil Gupta (Indy)

MEMBERSHIP

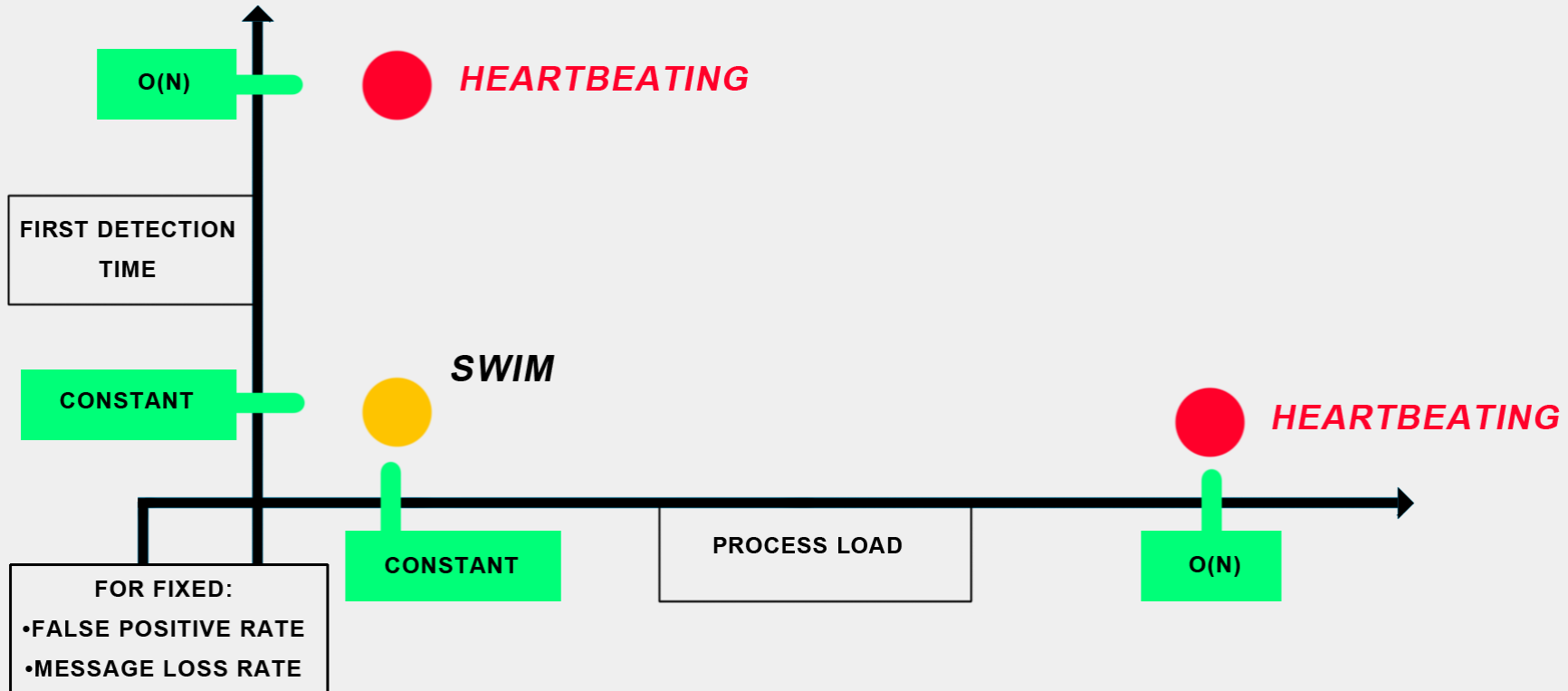
Lecture E

ANOTHER PROBABILISTIC
FAILURE DETECTOR

SWIM FAILURE DETECTOR PROTOCOL



SWIM VERSUS HEARTBEATING



SWIM FAILURE DETECTOR



PARAMETER	SWIM
First Detection Time	<ul style="list-style-type: none">•Expected $\left\lceil \frac{\ell}{\ell - 1} \right\rceil$ periods•Constant (independent of groupsize)
Process Load	<ul style="list-style-type: none">•Constant per period•$< 8L^*$ for 15% loss
False Positive Rate	<ul style="list-style-type: none">•Tunable (via K)•Falls exponentially as load is scaled
Completeness	<ul style="list-style-type: none">•Deterministic time-bounded•Within $O(\log(N))$ periods w.h.p.

ACCURACY, LOAD

- $PM(T)$ is exponential in $-K$. Also depends on pml (and pf)
- See paper

$$\frac{L}{L^*} < 28$$

$$\frac{E[L]}{L^*} < 8$$

for up to 15 % loss rates

DETECTION TIME

- Prob. of being pinged in $T' = 1 - (1 - \frac{1}{N})^{N-1} = 1 - e^{-1}$
- $E[T] = T' \cdot \frac{e}{e-1}$
- Completeness: *Any* alive member detects failure
 - Eventually
 - By using a trick: within worst case $O(N)$ protocol periods

TIME-BOUNDED COMPLETENESS

- Key: select each membership element once as a ping target in a traversal
 - Round-robin pinging
 - Random permutation of list after each traversal
- Each failure is detected in worst case $2N-1$ (local) protocol periods
- Preserves FD properties

NEXT

- How do failure detectors fit into the big picture of a group membership protocol?
- What are the missing blocks?