Interference-Resilient Information Exchange

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INFOCOM
April 23, 2009

My Talk in 30 Seconds or Less...

- We consider a *disrupted* radio channel.

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- We consider a *disrupted* radio channel.
- We describe a *fast* deterministic solution to information exchange in this setting.

From Closed to Open

Standard radio network model:

Our radio network model:

From Closed to Open

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- **Closed:** Only my guys exist.

Our radio network model:

From Closed to Open

Standard radio network model:

- **Closed:** Only my guys exist.

Our radio network model:

- **Open:** We're not alone.

Disrupted Radio Networks

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- All devices are known and start during the same round.
- Incarnate all sources of disruption in an interference adversary that can disrupt up to $t < \mathcal{F}$ frequencies per round.

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- Formally: a $(n-x)$-**to-**$(n-y)$ **information exchange protocol** guarantees that at least $(n-y)$ nodes learn at least $(n-x)$ rumors.

Multi-Selectors

Definition

An (n,c,k)-multi-selector of size m, where $n \geq c \geq k \geq 1$, is a sequence of functions $M_1, M_2, \ldots, M_m$ from $[1, n] \longrightarrow [1, c]$ such that:

> For every subset $S \subseteq [1, n]$ where $|S| = k$, there exists some $\ell \in [1, m]$ such that M_ℓ maps each element in S to a unique value in $[1, c]$.

Multi-Selectors: Example

Let $M = \{M_1, M_2\}$ be a $(4, 3, 2)$-**multi-selector** of size 2.

$\mathbf{M_1}$	$\mathbf{M_2}$
$\{1, 2, 34\}$	$\{12, 3, 4\}$

Multi-Selector Sizes

Theorem

For every $n \geq c \geq k^2$, there exists an (n, c, k)-multi-selector of size $O(k \log n/k)$.

The InfoExchange Protocol

We describe InfoExchange: an $O(n)$ solution to $(n-t)$-to-$(n-t)$ information exchange.

Preliminaries

Assumptions:

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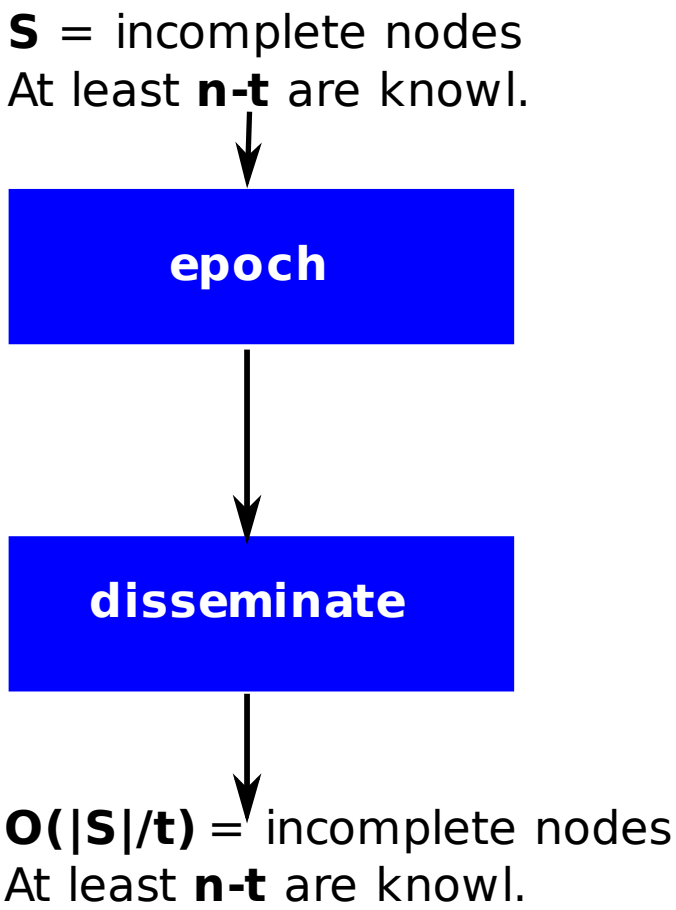
Notation:

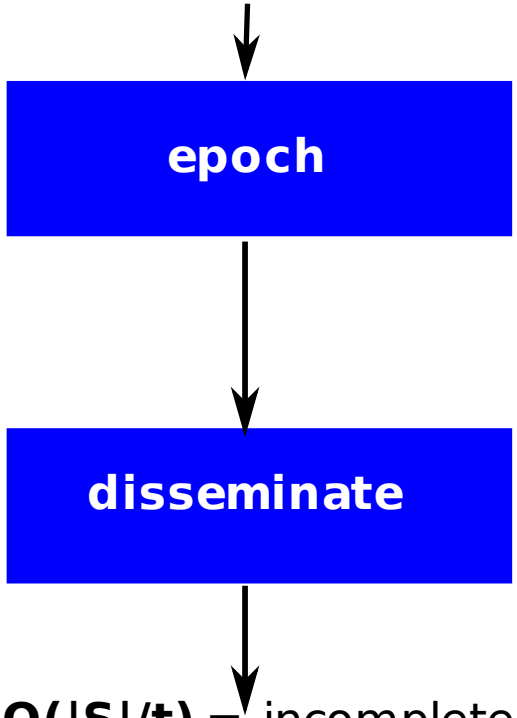
- A value v_u is *complete* if it is known by at least $n - t$ nodes.
- A node u is *knowledgeable* if it knows every complete value.

Protocol Structure



Protocol Structure

S = incomplete nodes
At least **n-t** are knowl.



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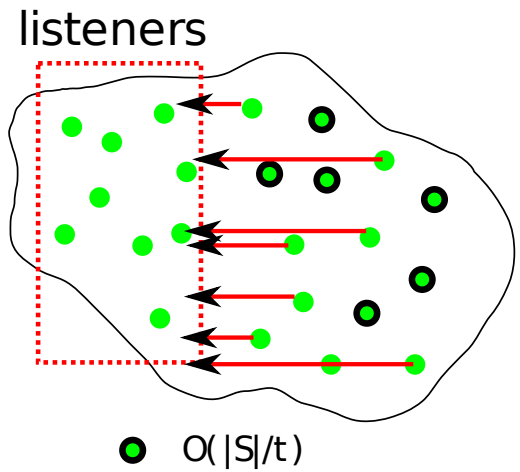

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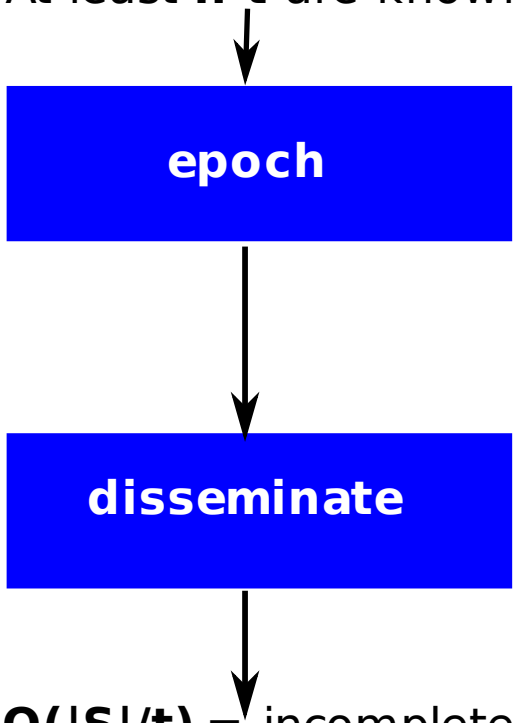

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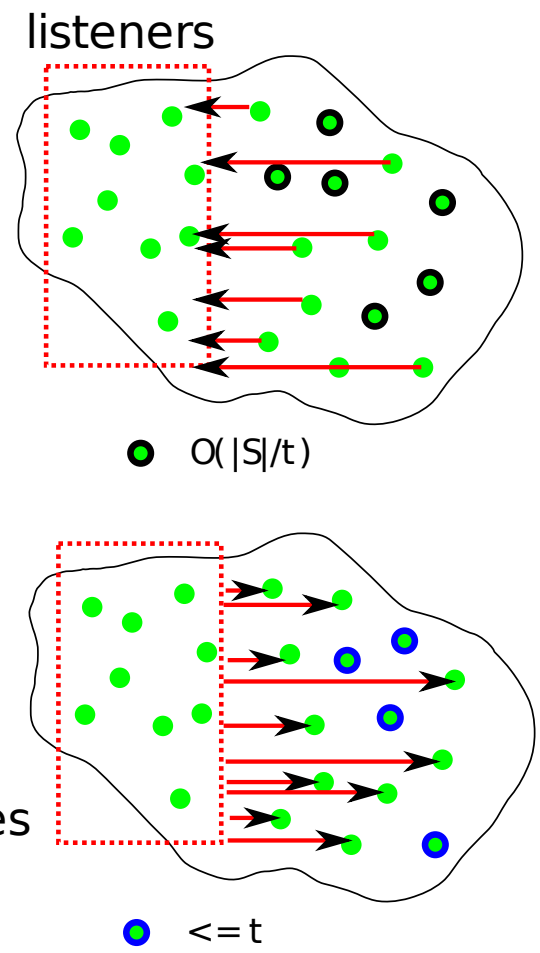

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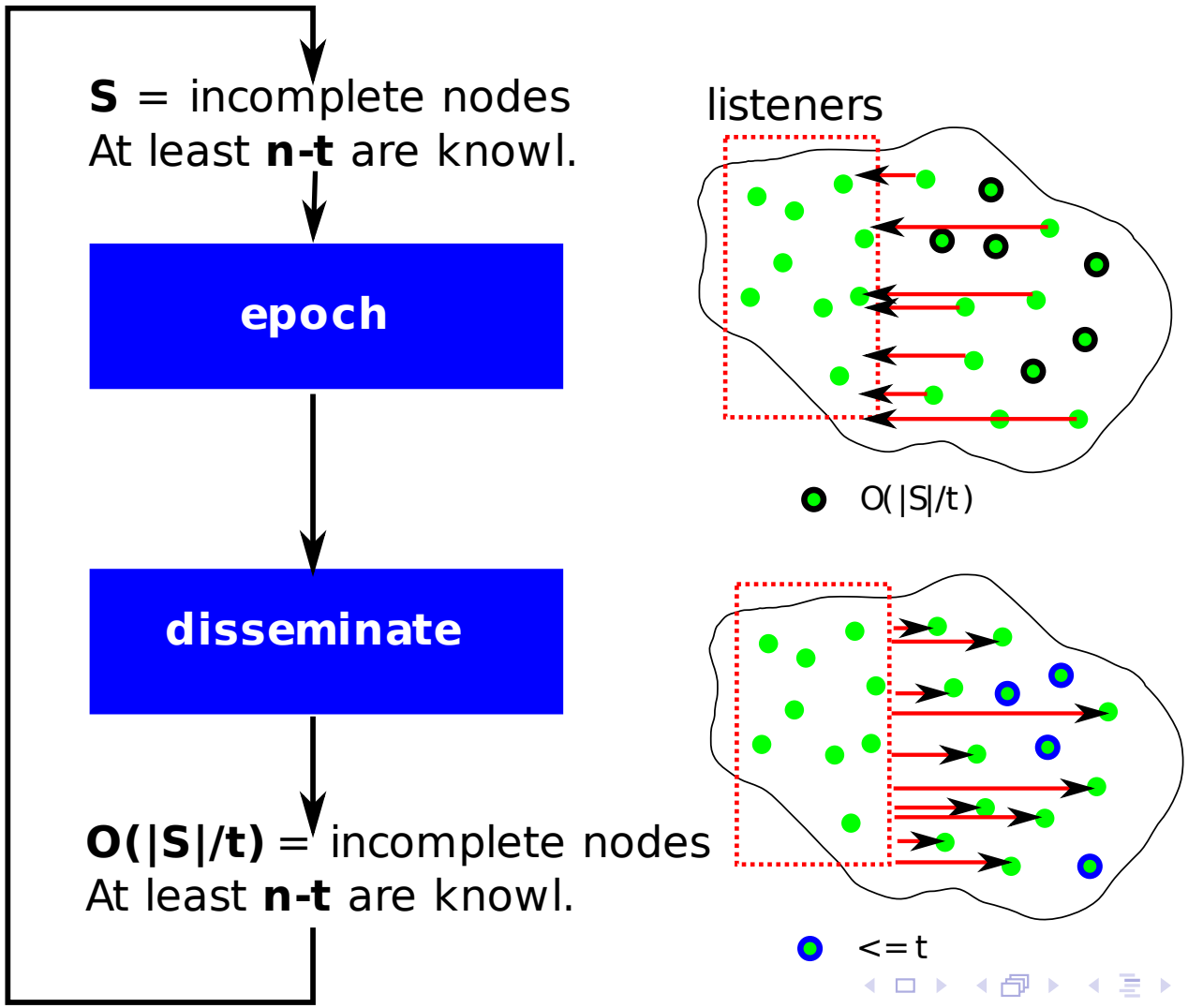
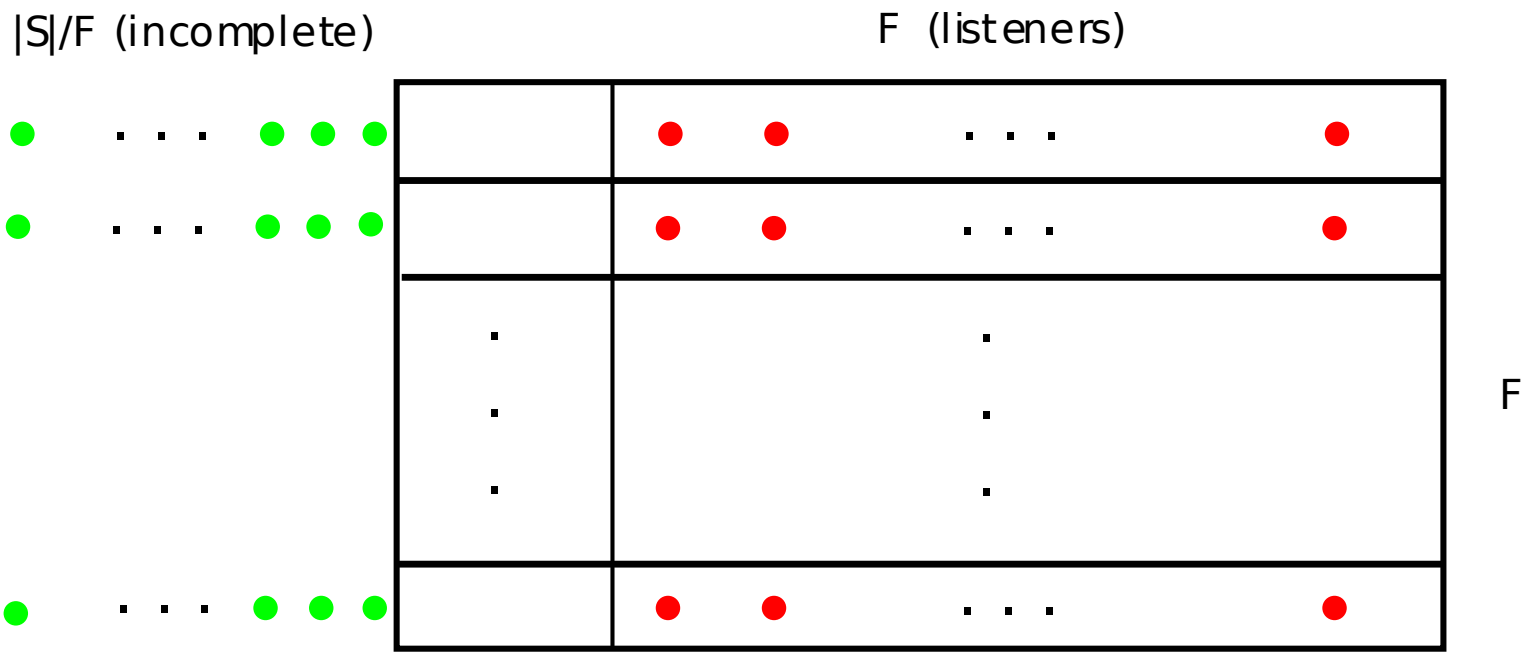


The Epoch Subroutine



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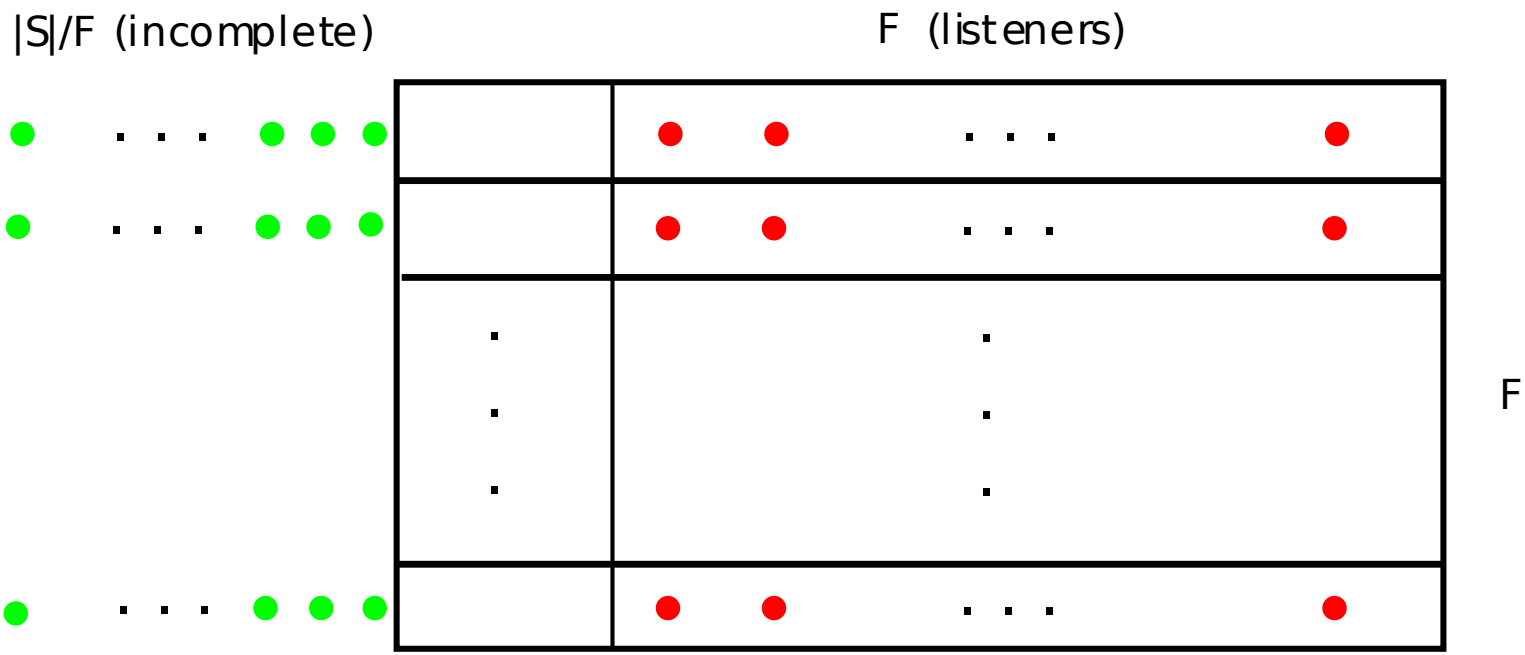

At most $(2t|S|)/\mathcal{F}$ are blocked.

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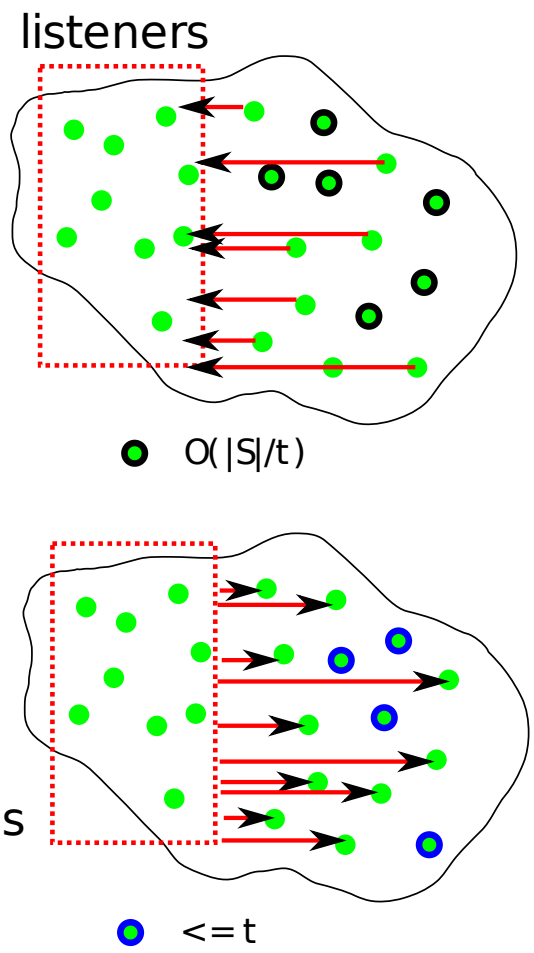

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- During round r non-disseminating node i receives on frequency $M_r(i)$.

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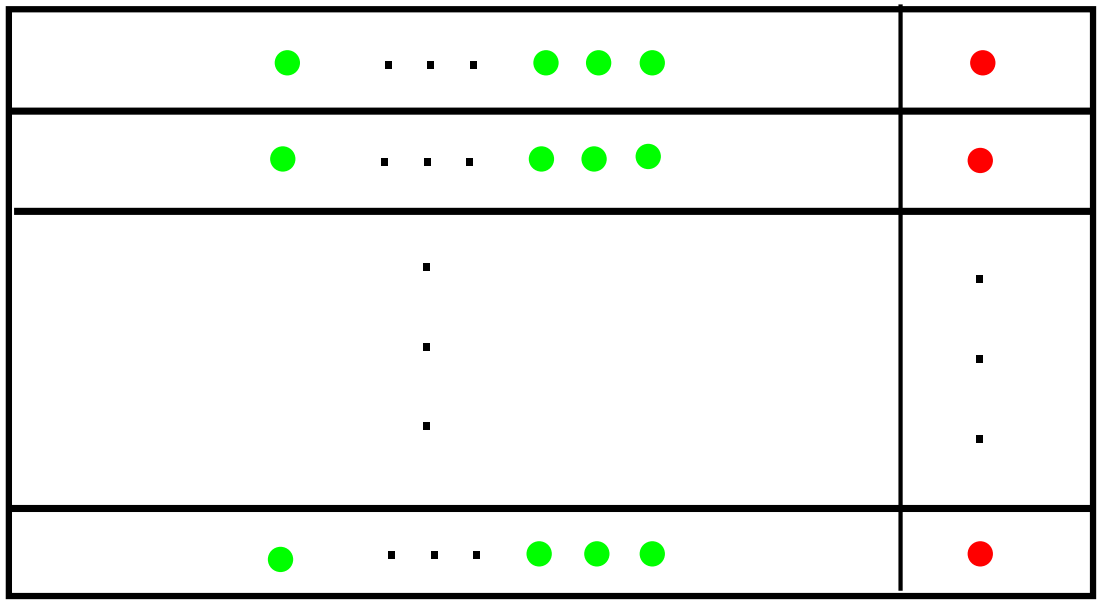
all i s.t. $M_r(i) = 1$



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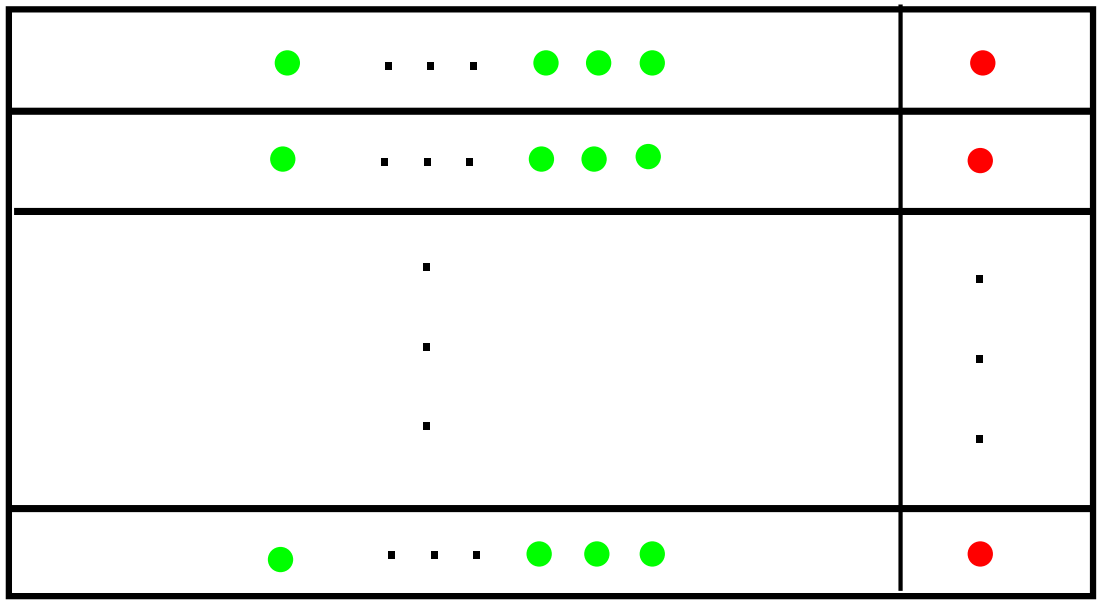

All but at most t hear from a listener.

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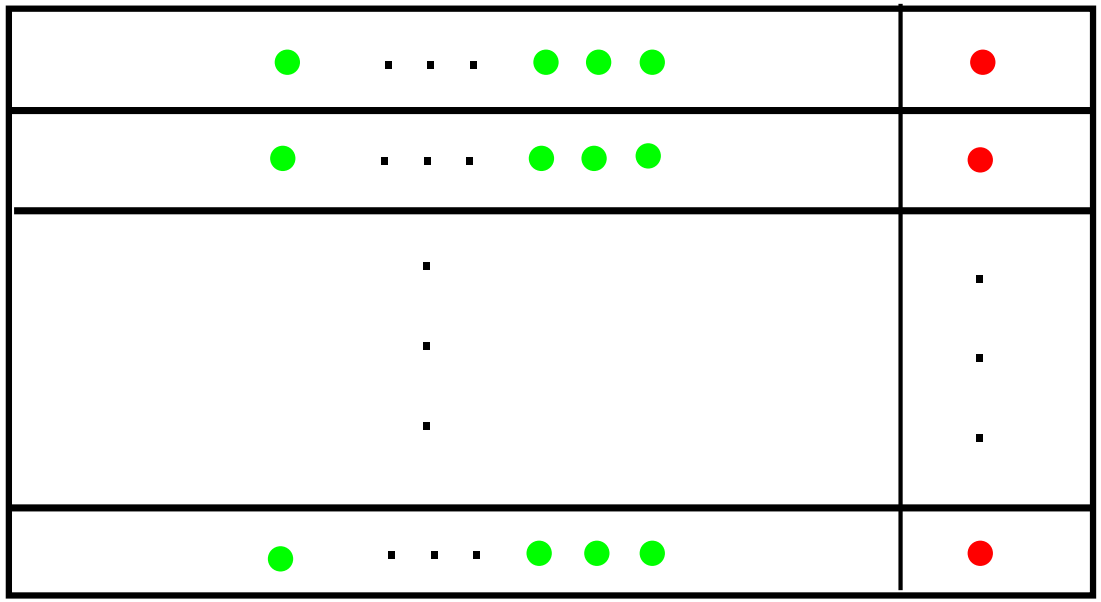

Repeat for all listener groups and all but $\mathcal{F}t$ learn *everything*.

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- One group is *good*.

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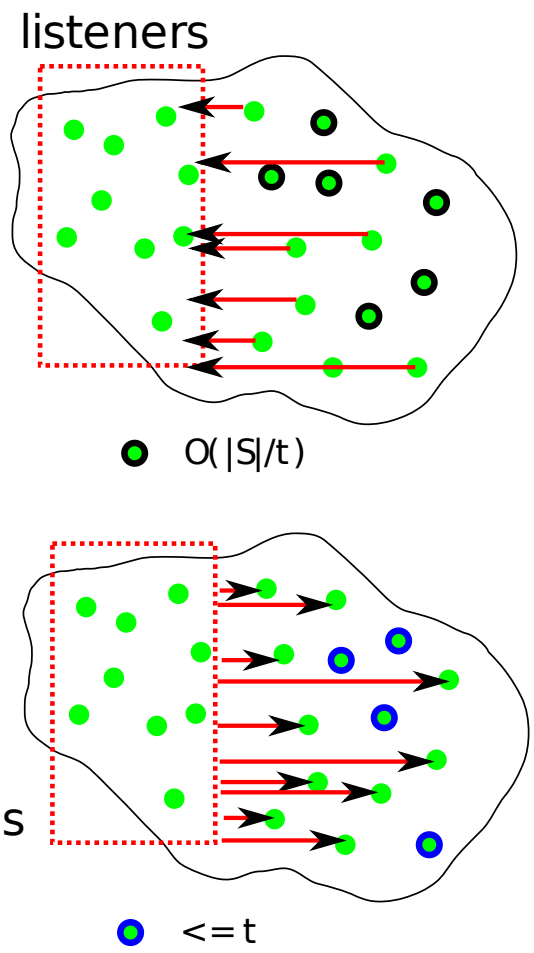

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We're done!

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- The $O(n)$ dominates.

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