

The Complexity of Verifying Population Protocols

Chana Weil-Kennedy

joint work with Javier Esparza, Stefan Jaax and Mikhail Raskin



European Research Council
Established by the European Commission

The project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 787367

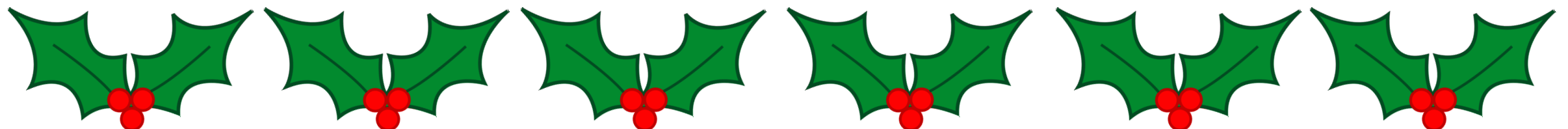


The Complexity of Verifying Population Protocols

A Table



	Complexity	Power
Standard (2-way)	TOWER-hard, decidable	$SLIN$
Immediate Observation	PSPACE-complete	$COUNT_*$
Delayed Observation	Π_2^P -complete	$COUNT_1$
Immediate Transmission	TOWER-hard, decidable	$SLIN \cap coreMOD$
Delayed Transmission	TOWER-hard, decidable	$SLIN \cap coreMOD$
Queued Transmission	TOWER-hard	$SLIN$



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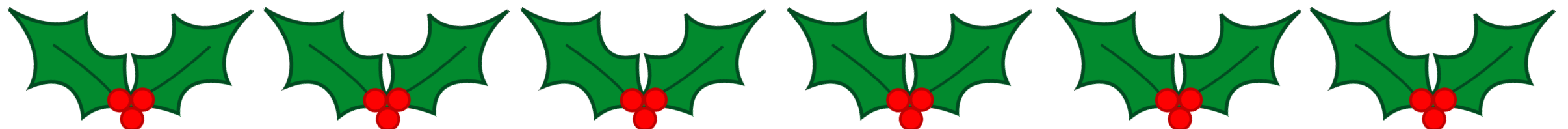
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[Esparza et al., '17]

[Angluin et al., '07]

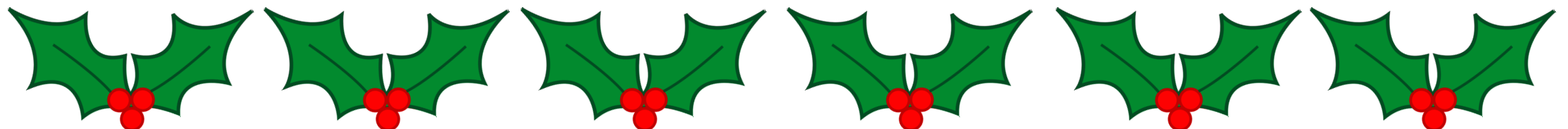


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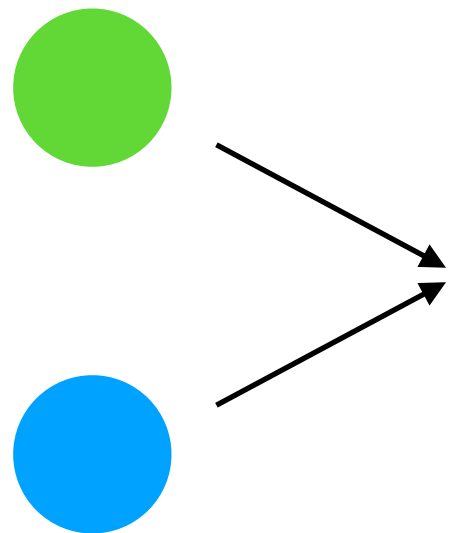


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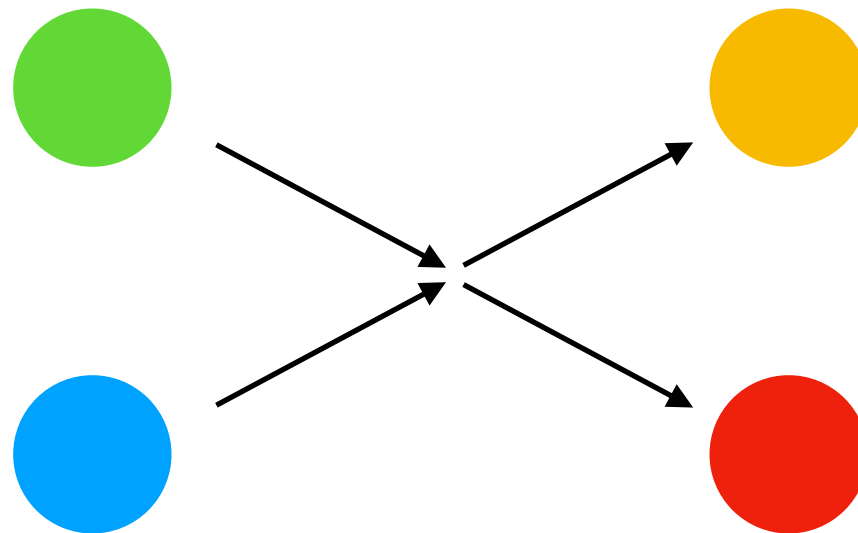
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Standard (2-way)	TOWER-hard, decidable	<i>SLIN</i>
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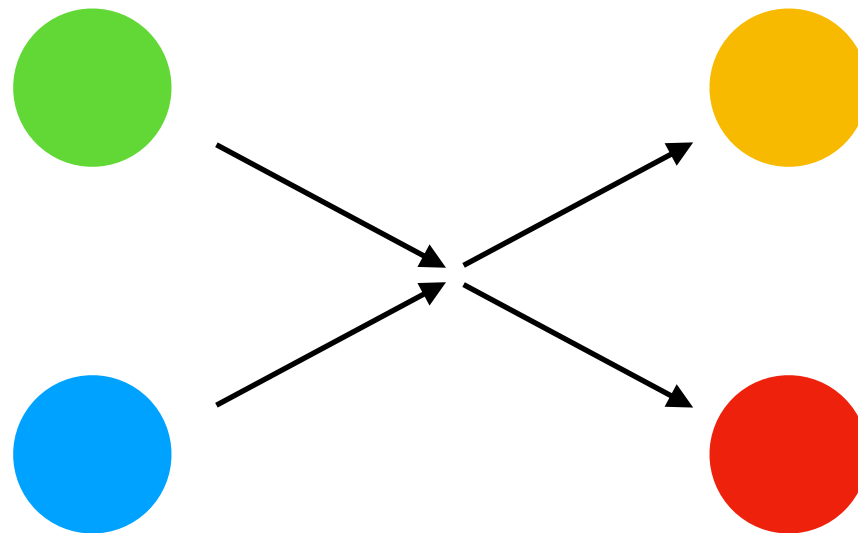
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$$(x \equiv_2 1) \wedge (x \leq 2y + 1)$$

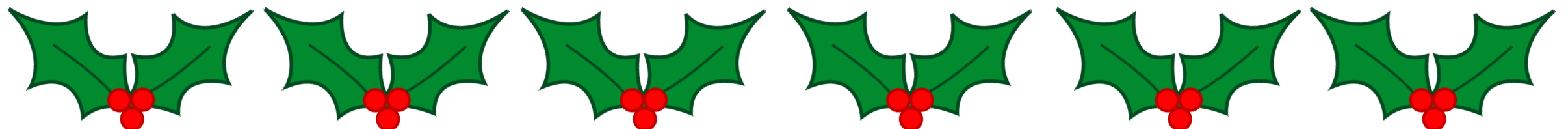


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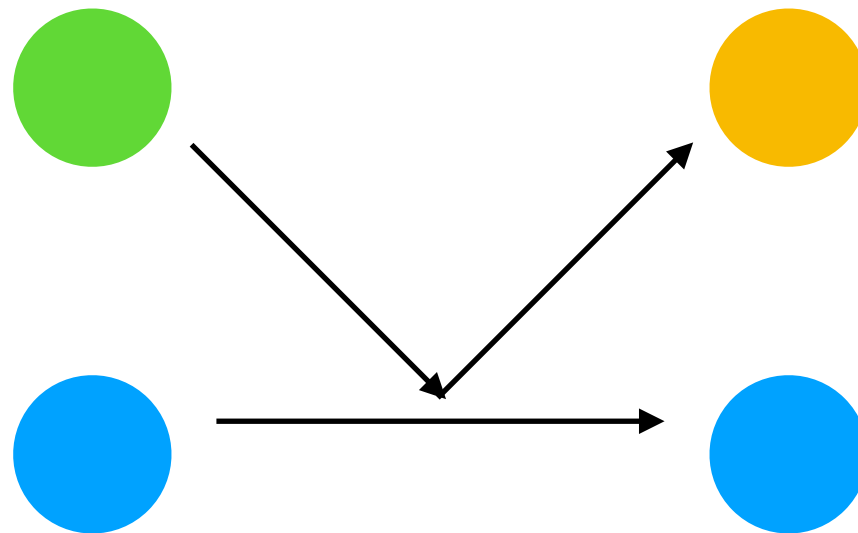


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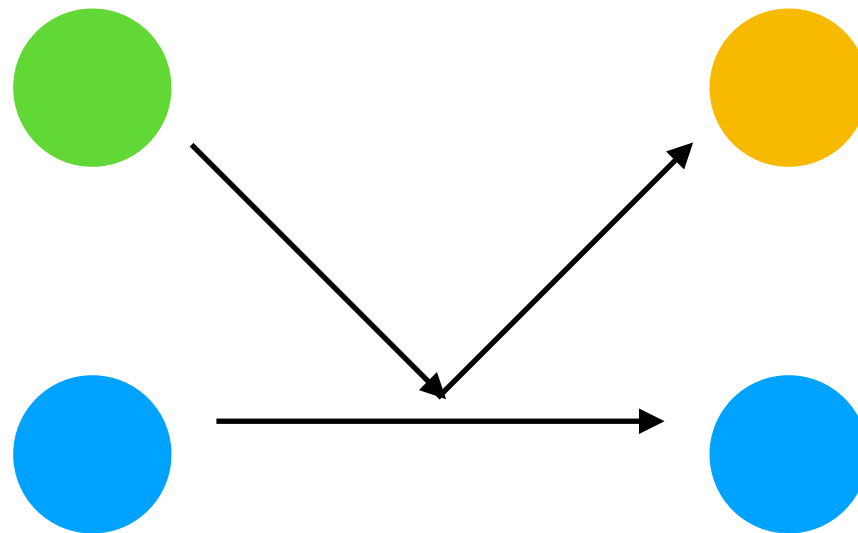
Immediate Observation	PSPACE-complete	$COUNT_*$
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Immediate Observation	PSPACE-complete	$COUNT_*$
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$x \leq 5$

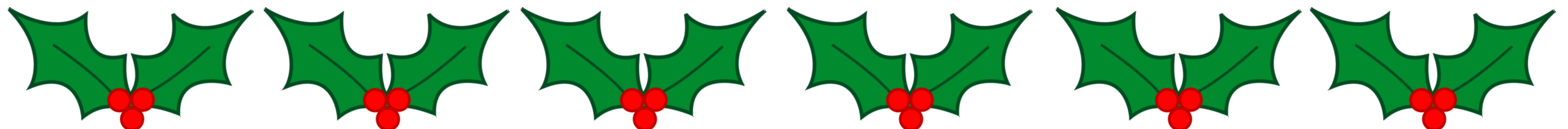


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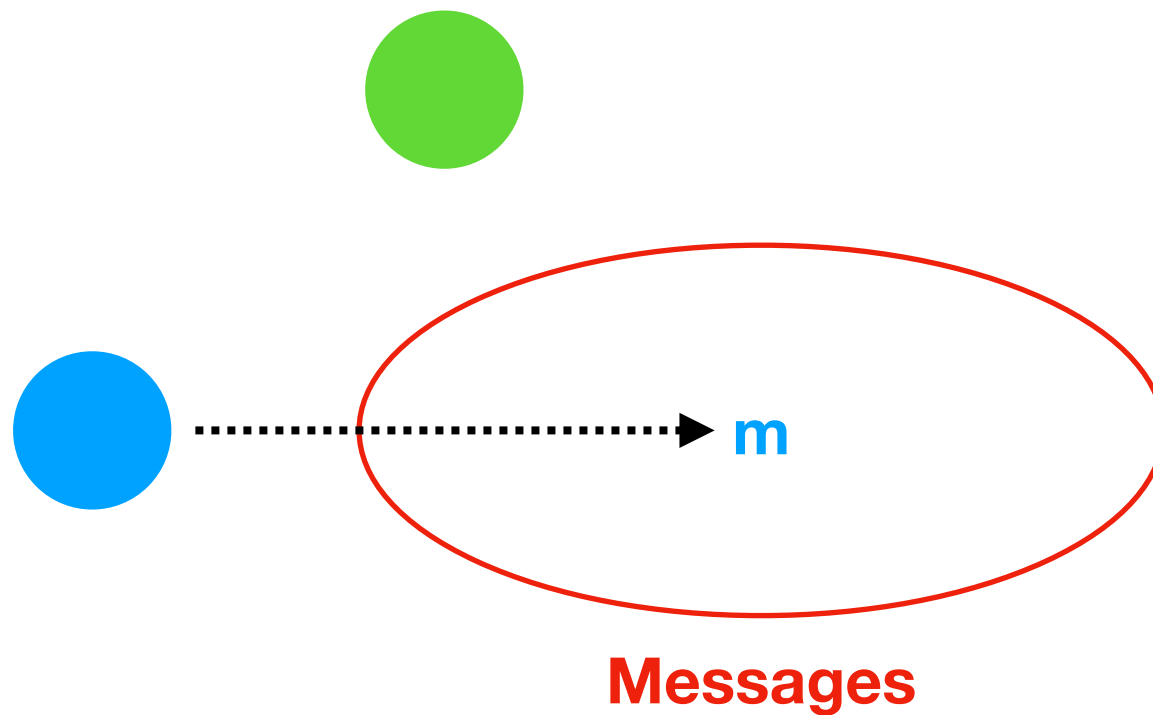


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Delayed Observation	Π_2^p -complete	$COUNT_1$
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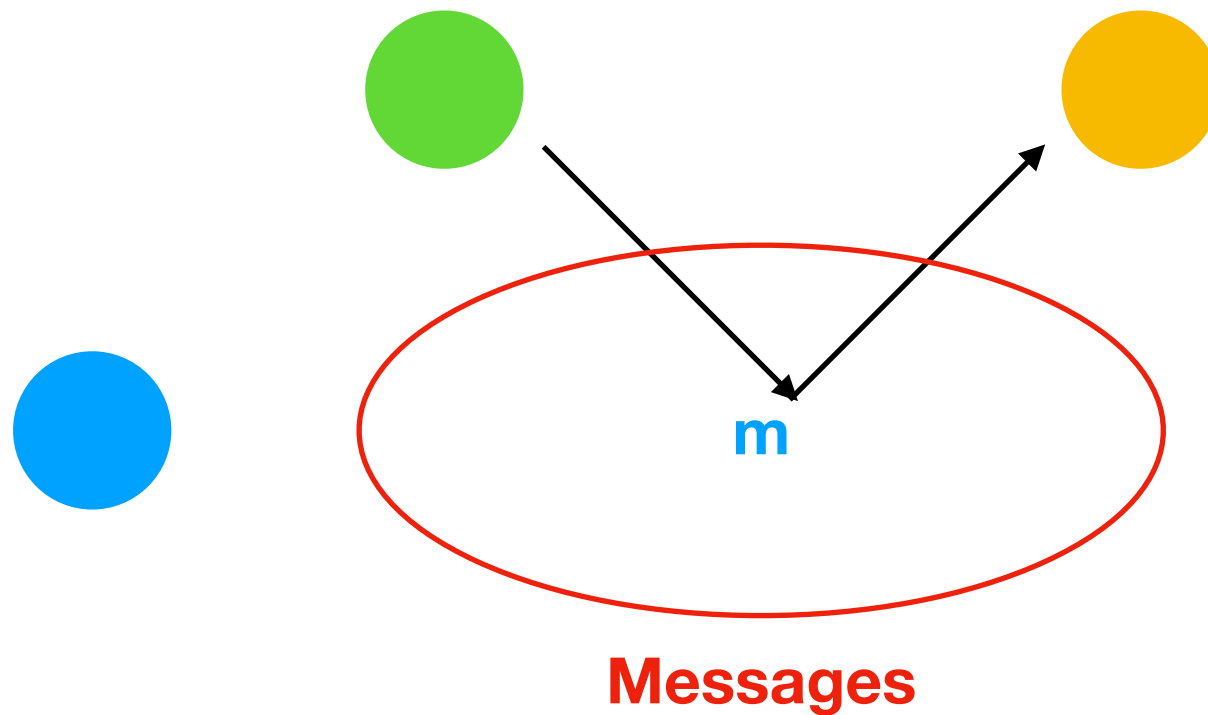


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Delayed Observation	Π_2^p -complete	$COUNT_1$
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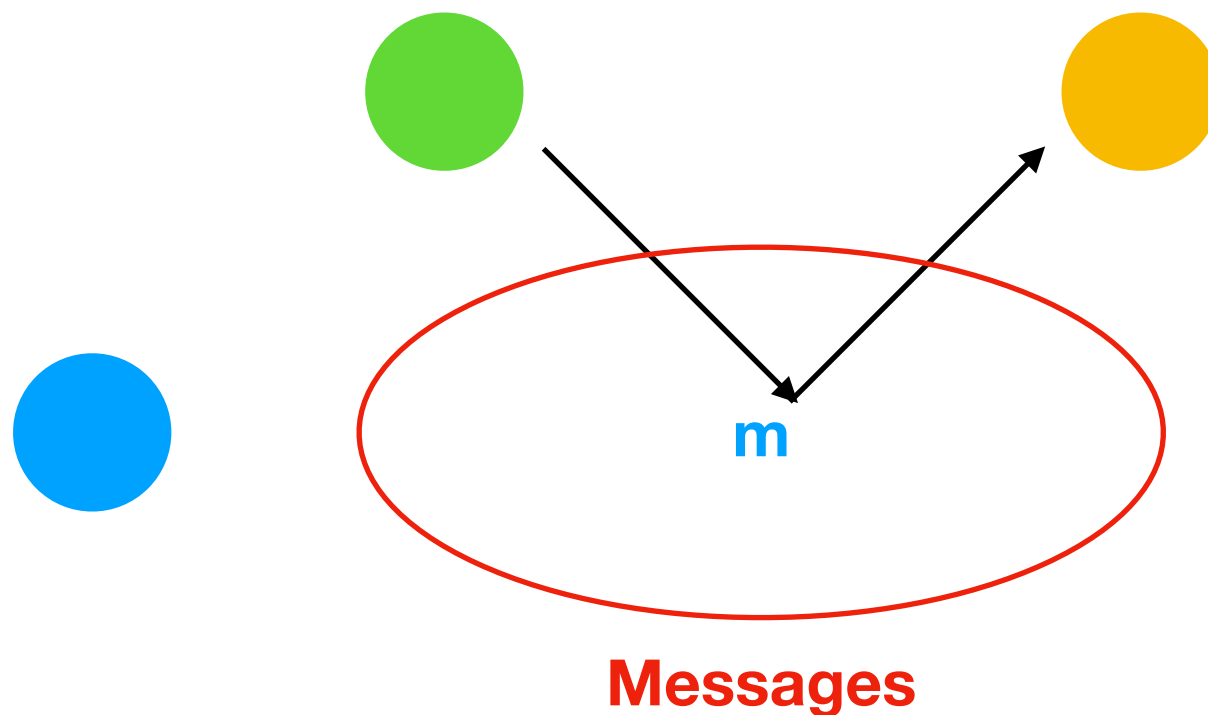
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Delayed Observation	Π_2^p -complete	$COUNT_1$
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$x \geq 1$

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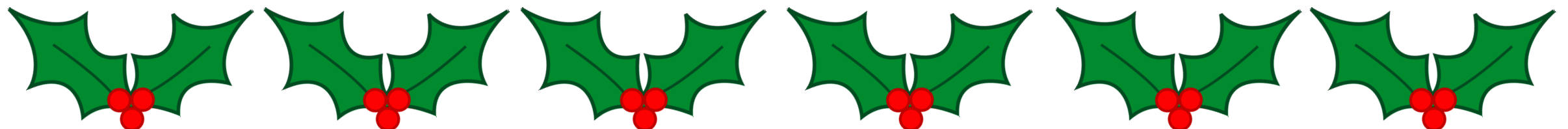


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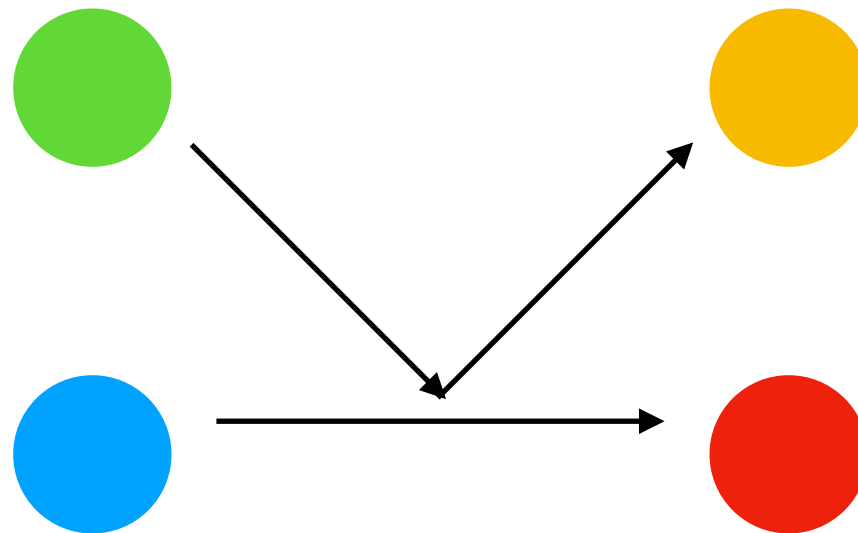
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Immediate Transmission	TOWER-hard, decidable	$SLIN \cap coreMOD$
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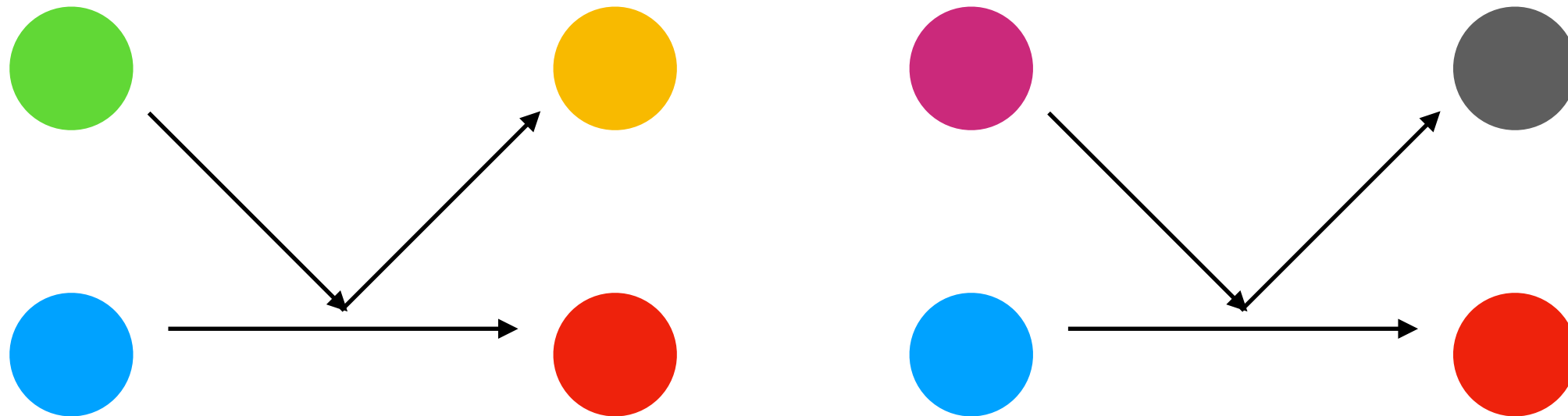
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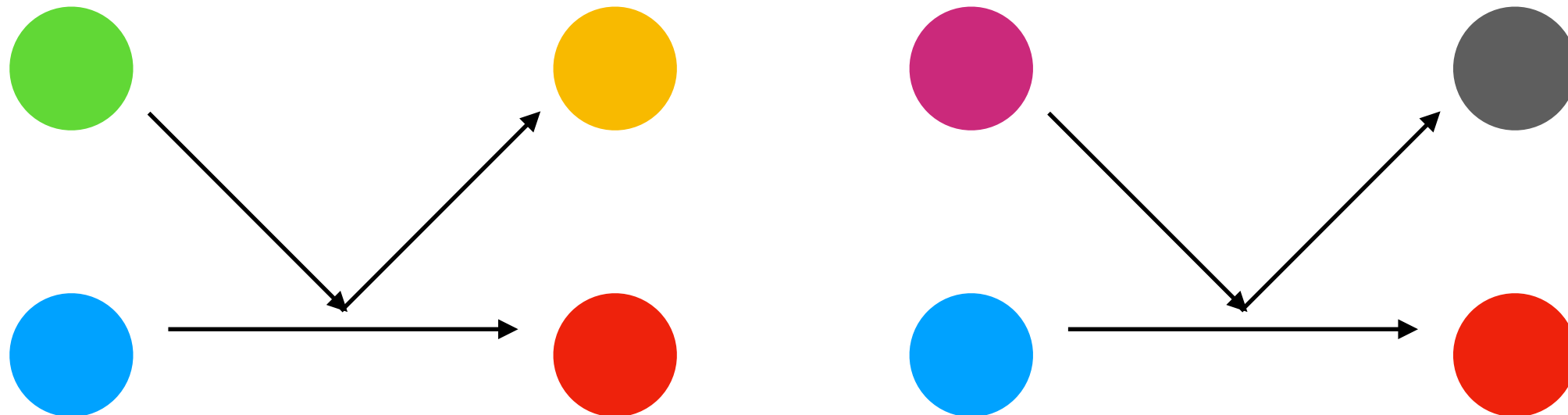


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Immediate Transmission	TOWER-hard, decidable	$SLIN \cap coreMOD$
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$(x \equiv_2 1)$

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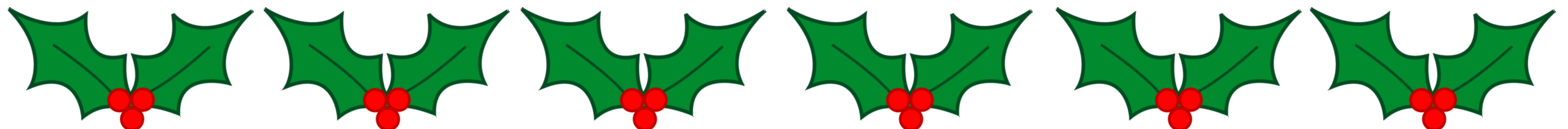


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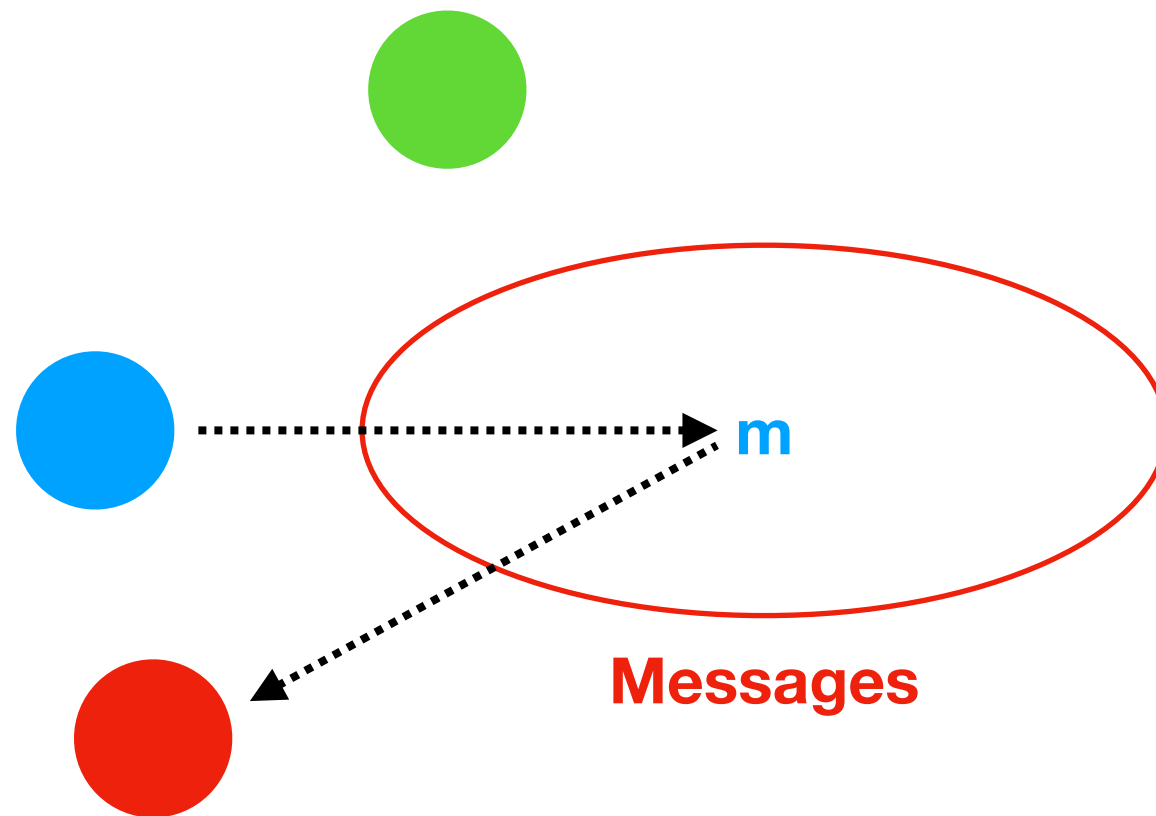


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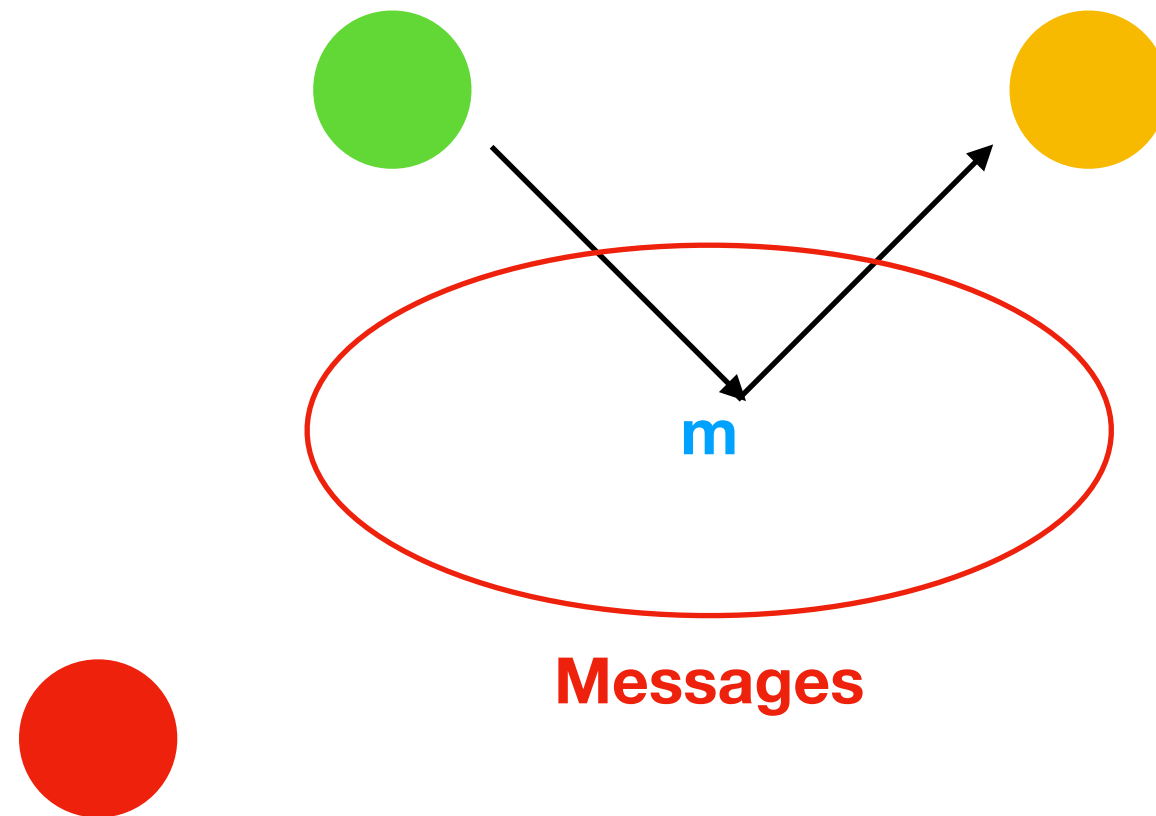
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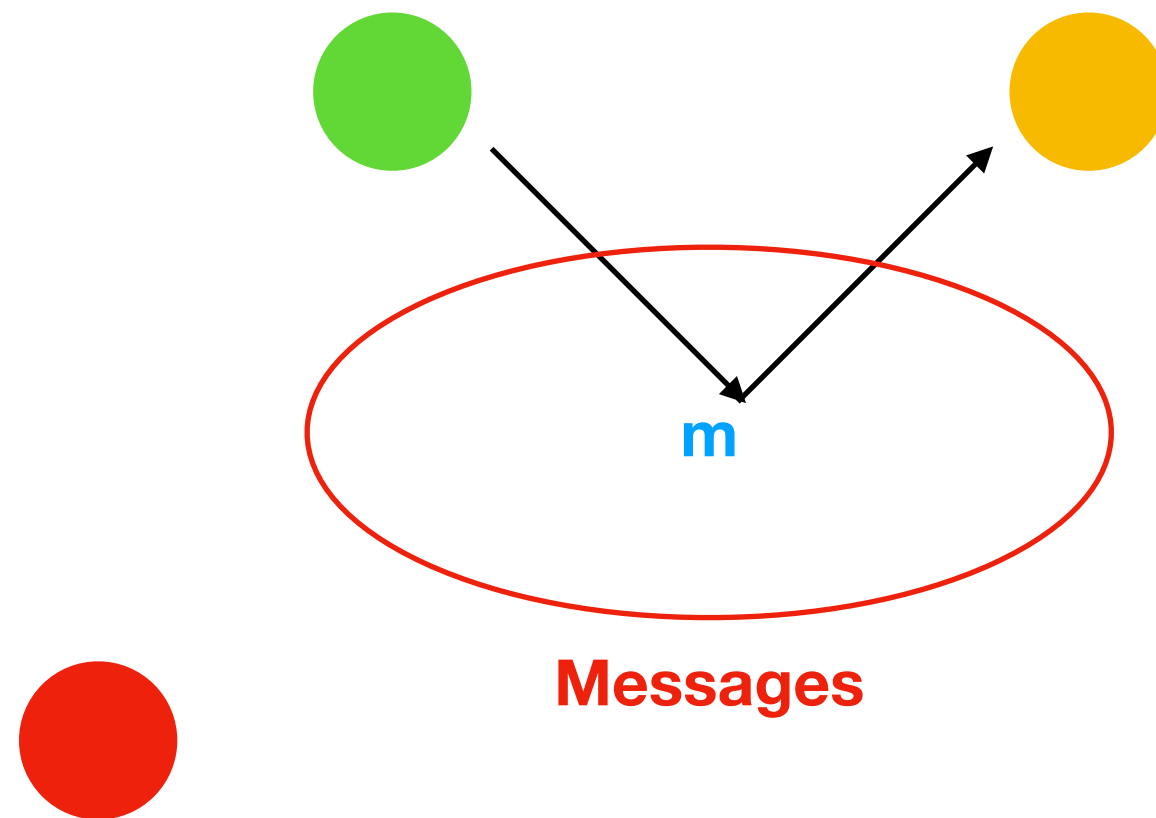
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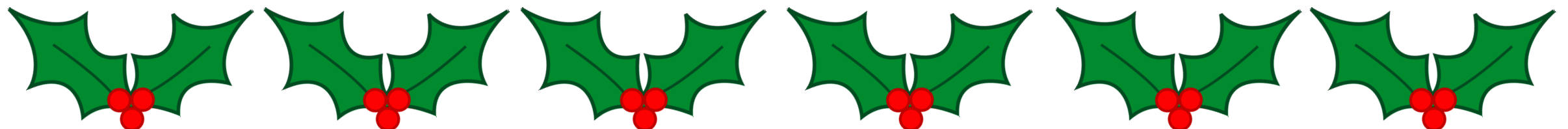
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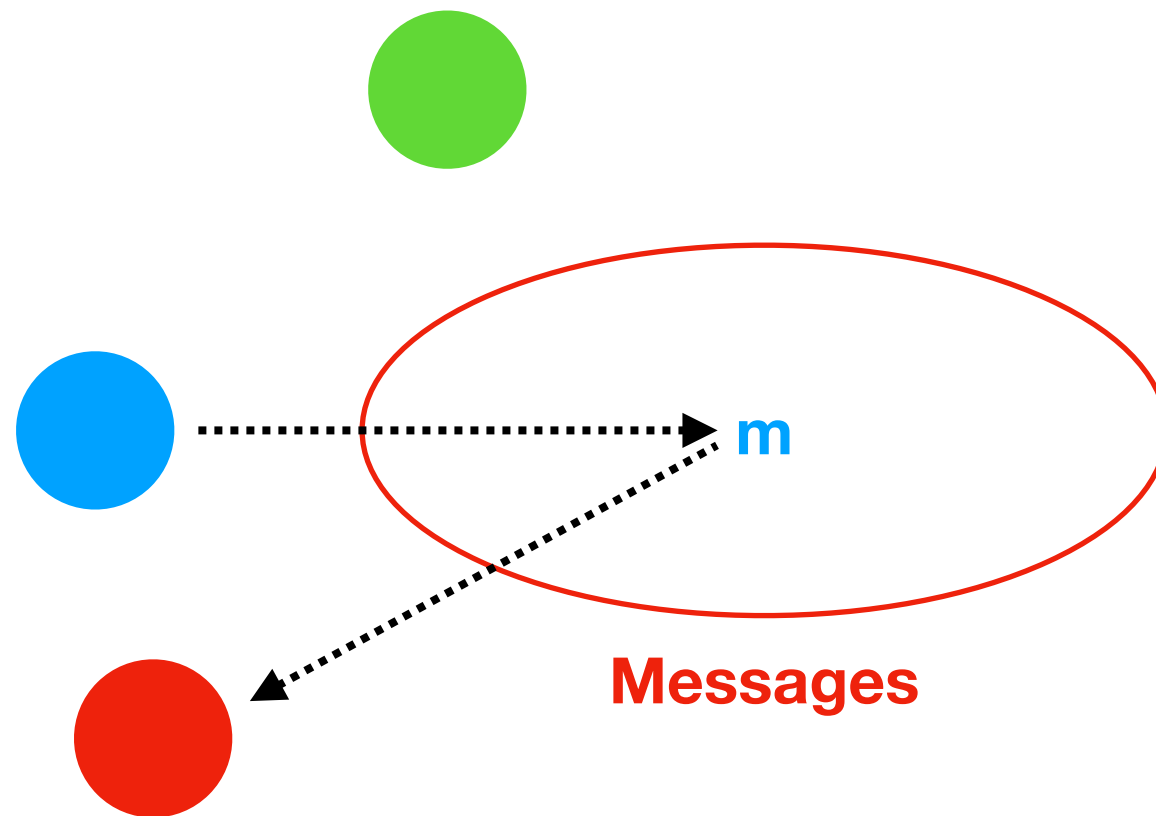


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Queued Transmission	TOWER-hard	<i>SLIN</i>
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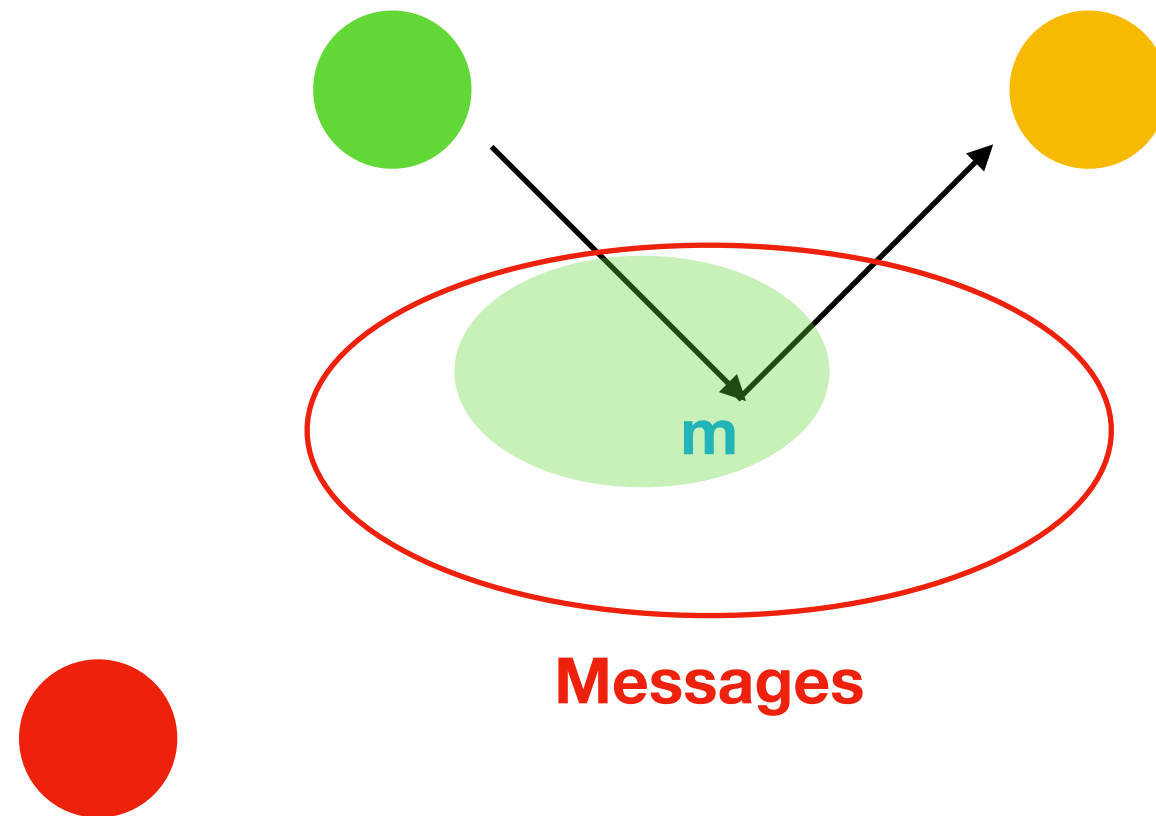


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Queued Transmission

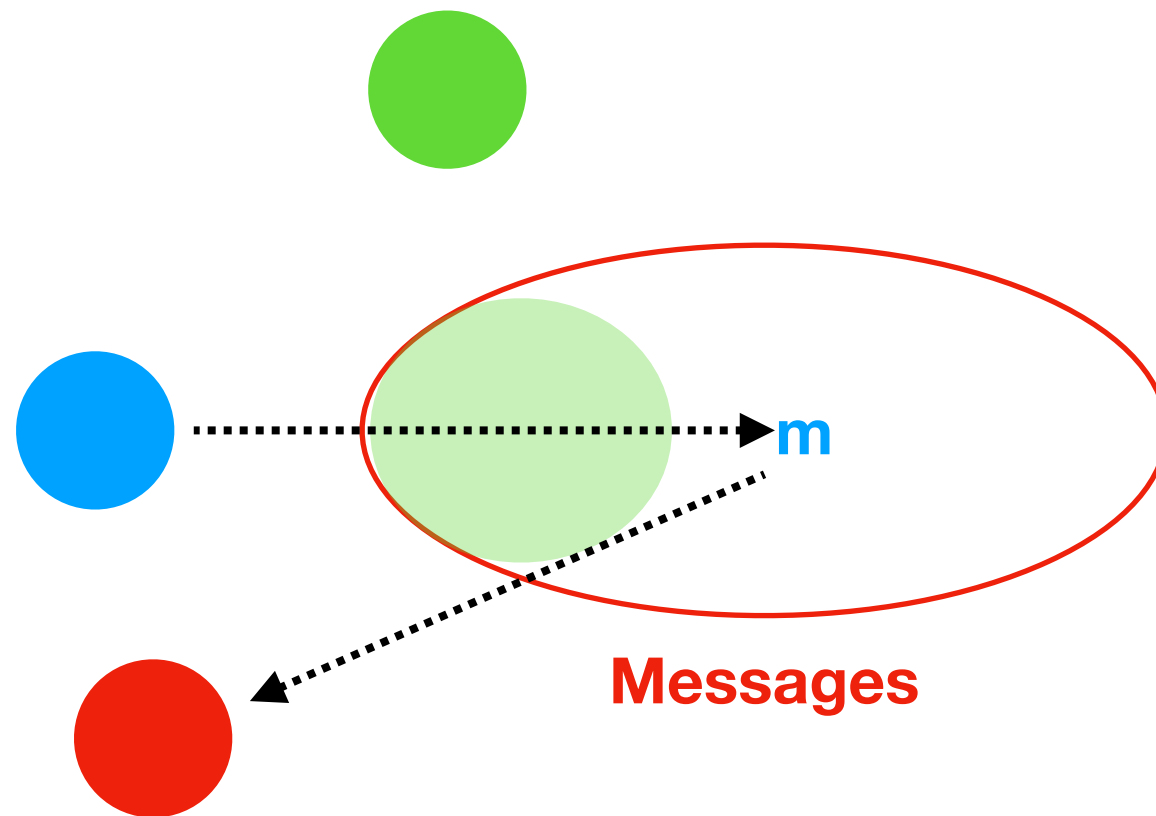
TOWER-hard

SLIN



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Queued Transmission	TOWER-hard	<i>SLIN</i>
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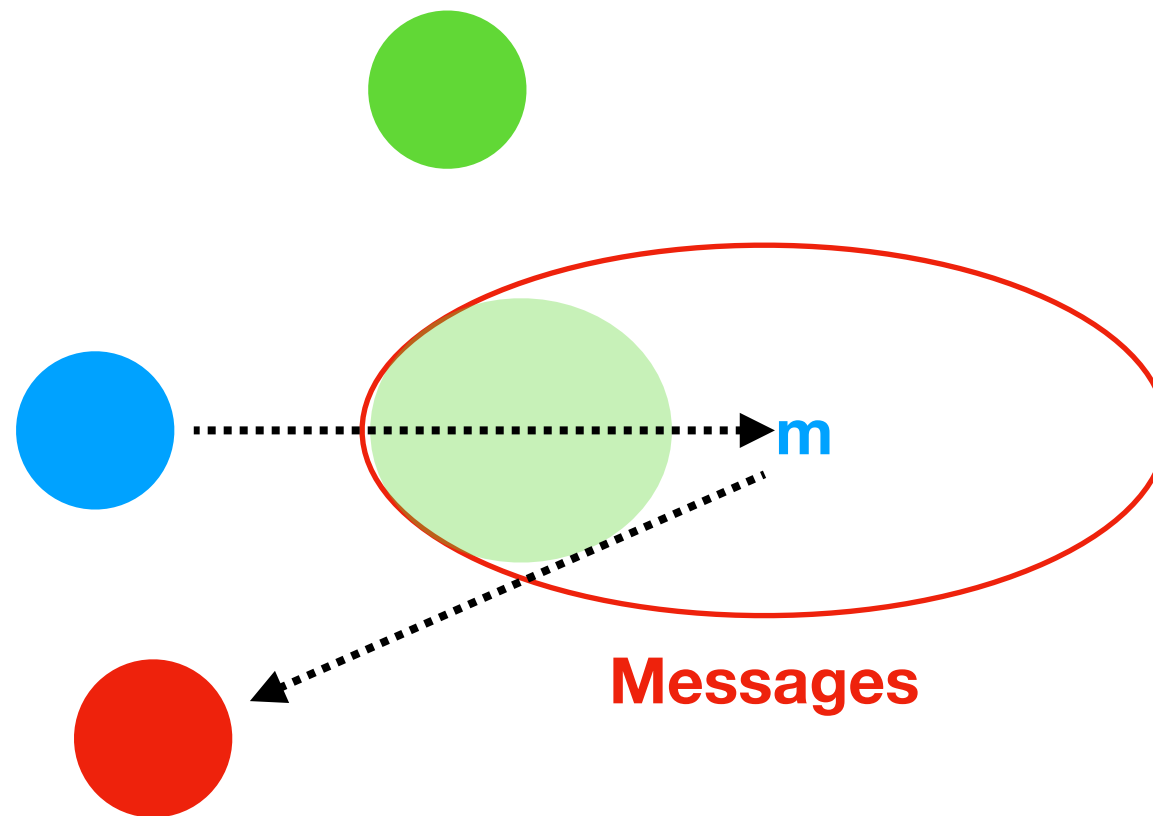
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Queued Transmission

TOWER-hard

SLIN

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The Complexity of Verifying Population Protocols

Queued Transmission

TOWER-hard

SLIN

and maybe not decidable!

$$(x \equiv_2 1) \wedge (x \leq 2y + 1)$$

