

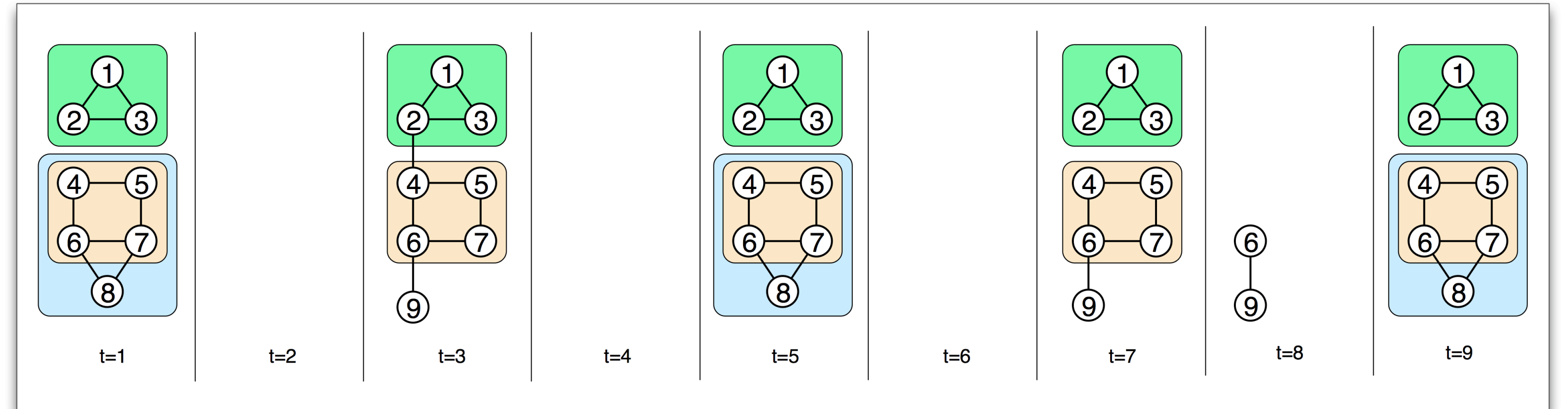
1. Introduction

- Regular temporal patterns** are found in many real-world **encounter networks**.
- Identifying **communities of individuals** that **regularly meet** has applications in areas such as opportunistic unicast delivery, content sharing, and trust.
- In the absence of knowledge of the whole network, a **decentralised solution** is required to allow individuals to identify their periodic communities.



2. Periodic Encounter Communities

- A **dynamic encounter network** (DEN) is a time series of encounter graphs.
- Each **encounter graph** represents the encounters occurring during a particular time step.

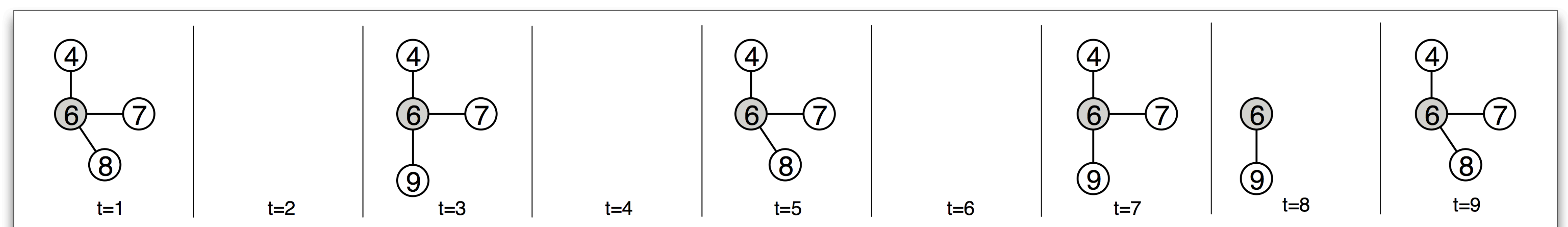


Example dynamic encounter network

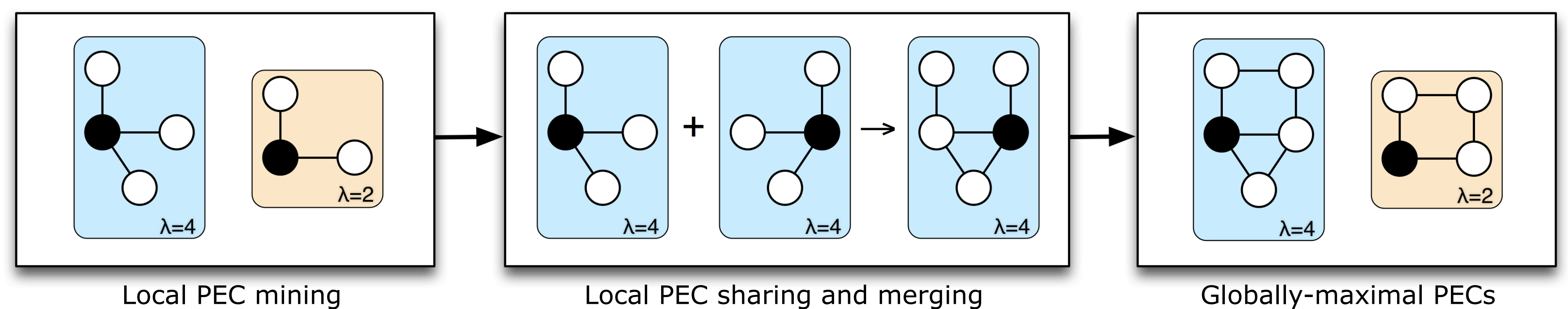
- A **periodic encounter community** (PEC) is a connected subgraph that reappears in a DEN with a fixed period.

3. Decentralised PEC Detection

- The objective is for each node to discover all the PECs it belongs to.
- Discovered PECs should be **harmonically, structurally, and temporally maximal**.
- Nodes have available only knowledge of their local encounters. We refer to a node's local DEN as its **intrinsic DEN**.
- Periodic subgraph mining** extracts locally maximal PECs from the node's intrinsic DEN.
- From **local mining** and **local PEC sharing**, globally maximal PECs are obtained.



Intrinsic dynamic encounter graph of node 6



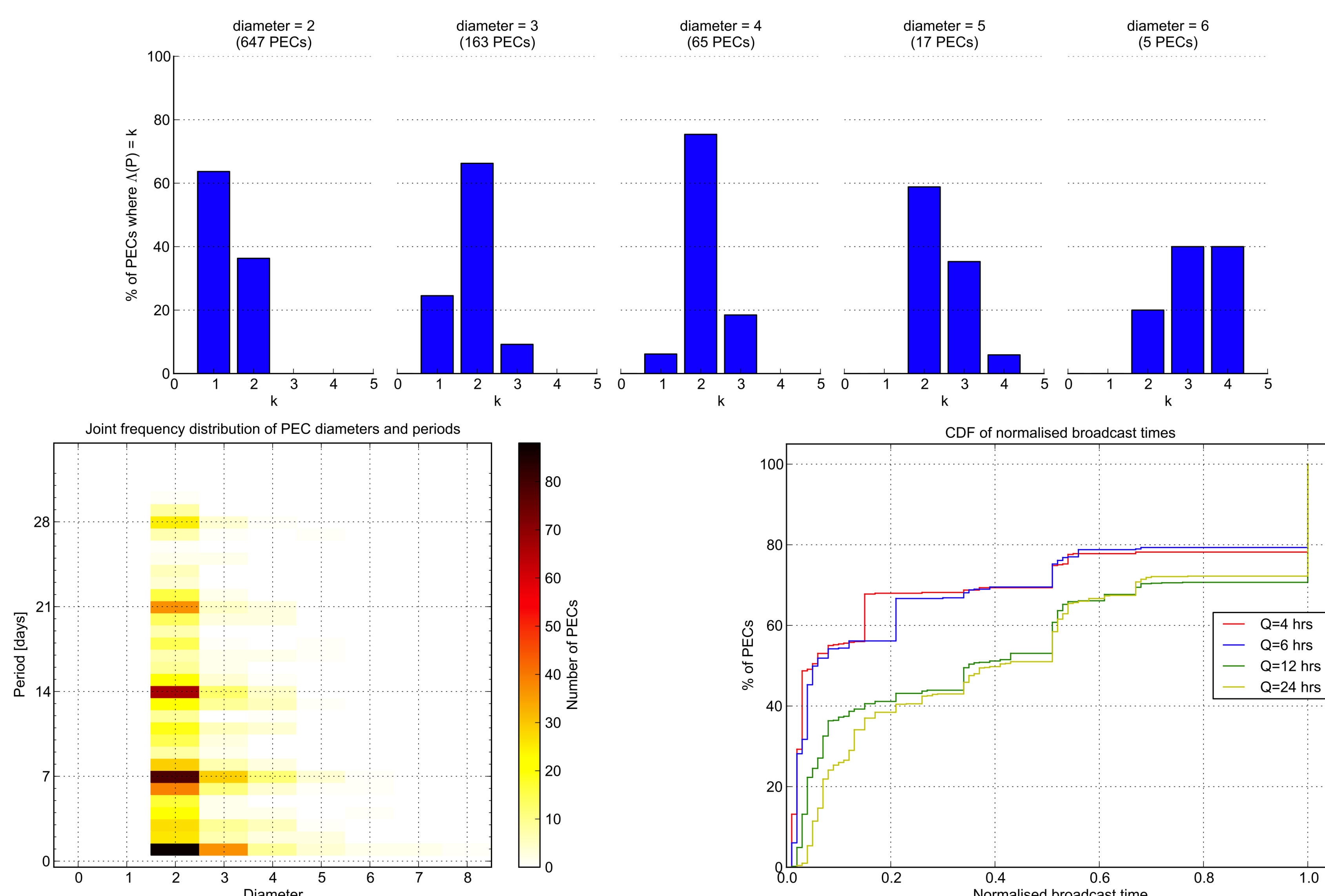
Local PEC mining

Local PEC sharing and merging

Globally-maximal PECs

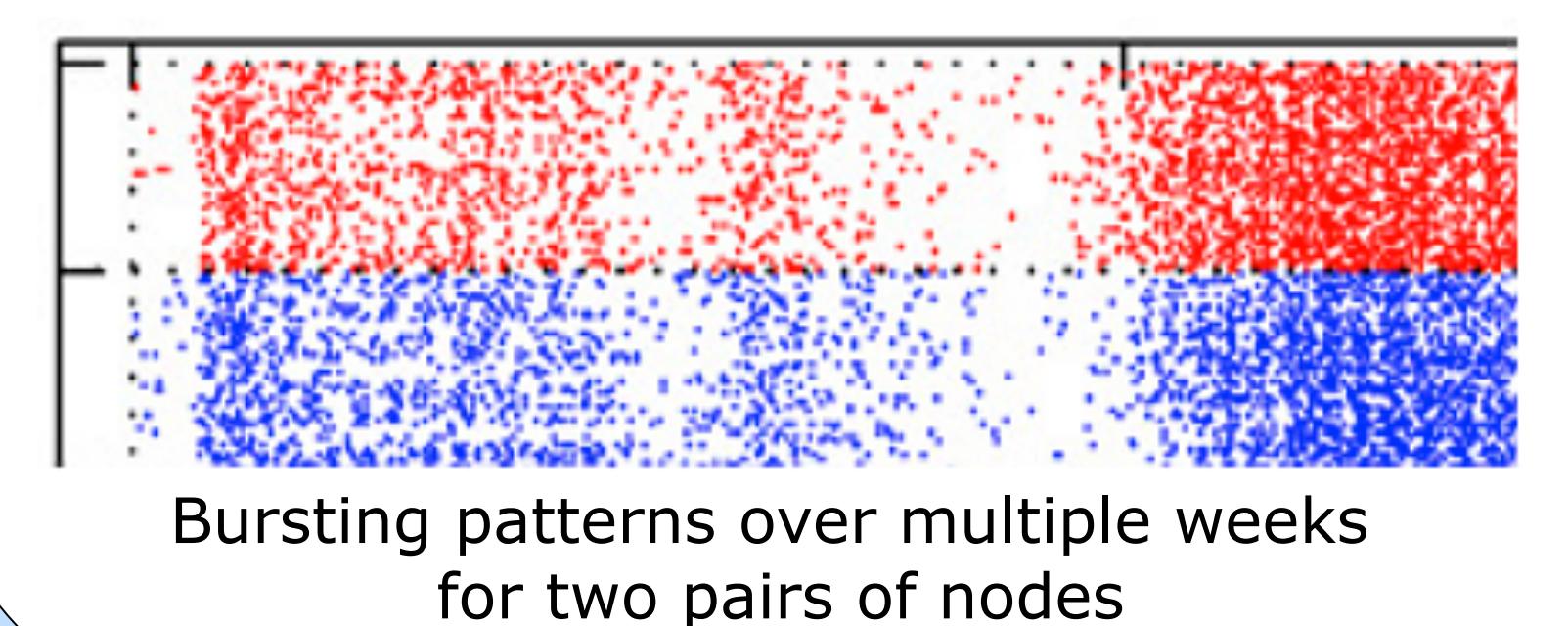
4. Results

- Broadcast time** is the time for all nodes in a PEC to broadcast to all other nodes in the PEC.
- PEC diameter** is the longest of the shortest paths between any two nodes.
- Diameter bounds broadcast time**: The worst-case broadcast time is a function of the PEC period and PEC diameter. We normalise broadcast time by the worst case.



5. Discussion

- Despite worst-case broadcast time increasing with diameter, actual broadcast time stays small.
- The strictness of the PEC definition is a limitation of this approach. Uncertainty is not modelled.
- Current work is to develop fuzzy measures for pairwise regularity.
- New method: compare instantaneous encounter rates between different weeks for the same pair.



Bursting patterns over multiple weeks for two pairs of nodes