Multipath ChaMeLeon (M-CML): A multipath hybrid routing protocol for MANETs

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Introduction

- The multipath *ChaMeLeon* (M-CML) is the multipath version of *ChaMeLeon* version 2 (CMLv2) routing protocol.

- A multi-path, hybrid and adaptive routing protocol for MANETs that operates within a defined area denoted as the Critical Area

- The autonomous nature of MANETs is very suitable for a variety of scenarios

  - changes in e.g. node density, delay profile, energy consumption

  - multiple disjoint paths exist

M-CML

- **Aim**: To increase overall efficiency (throughput, delay and energy efficiency) of pure approaches based on the network state.
- **Nature**: hybrid and adaptive according to network scenarios.
- **Application**: Primarily designed for emergency MANETs but could be used for general purpose MANETs.
- **Functionality**: 4 phases of operation (P-phase, M-phase, R-phase and O-phase).
  - A phase is a routing or data analysis state including the added interaction with the M-CML Adaptive Module.
- **CML messages**: Change Phase (CP), Hop Count Request (HCReq) and Hop Count Reply (HCRep) Message.

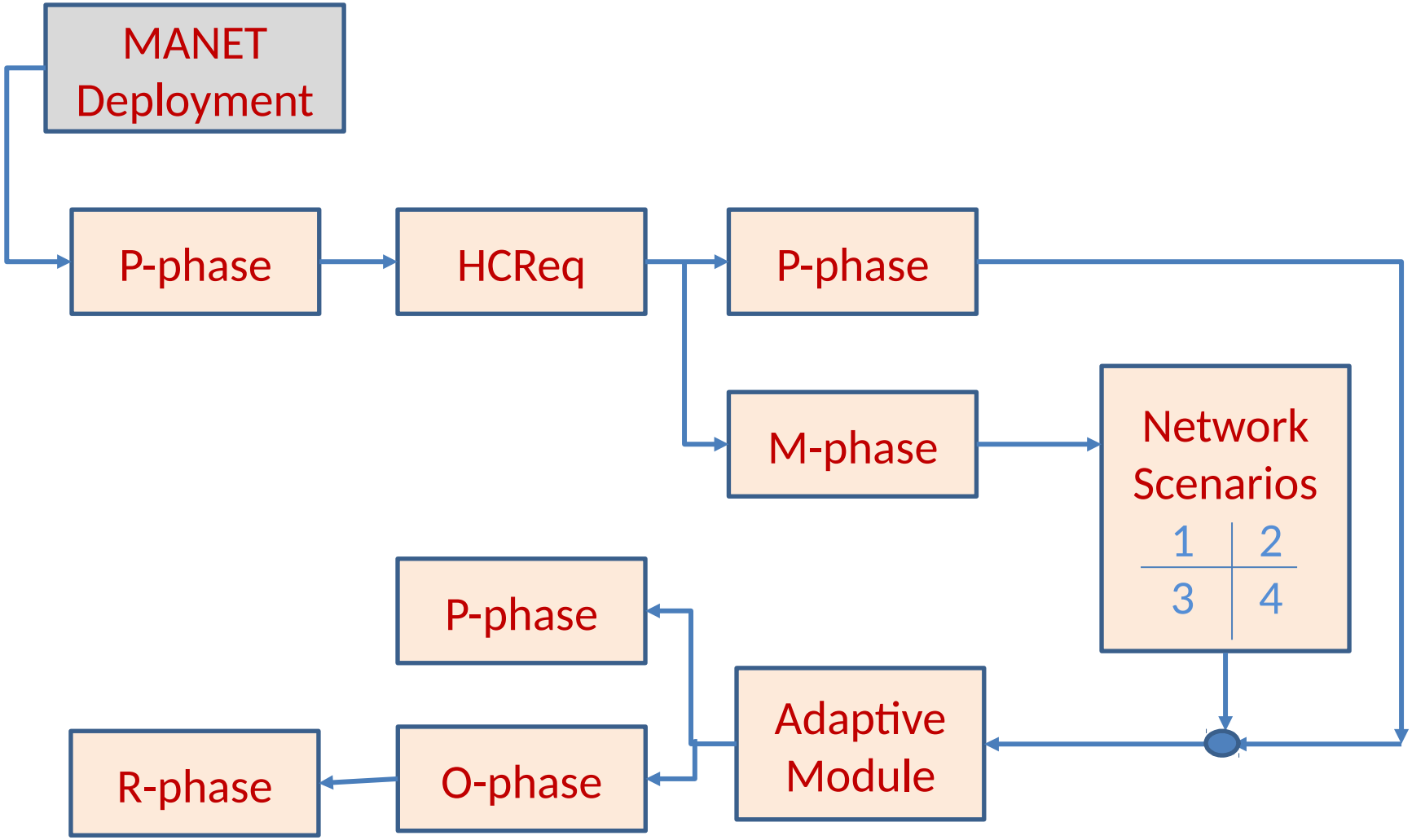
M-CML Overview (1)

- Adapt its routing behavior (or phases) on-the-fly according to the changes in MANET network behavior
  - Mobility, node density, energy consumption, QoS
- MANET implementation ▭ default is proactive routing (P-phase) ▭ multi-path OLSR v2
- Monitoring phase (M-phase) is triggered when HCreq is received by MANET nodes, i.e., M-phase runs within the P-phase
- Reactive phase (R-phase) is triggered when network scenario favours reactive routing ▭ AODV v2
- Oscillation (O-phase) is the transition phase (P to R, R to P) to generate and maintain new routing protocol table

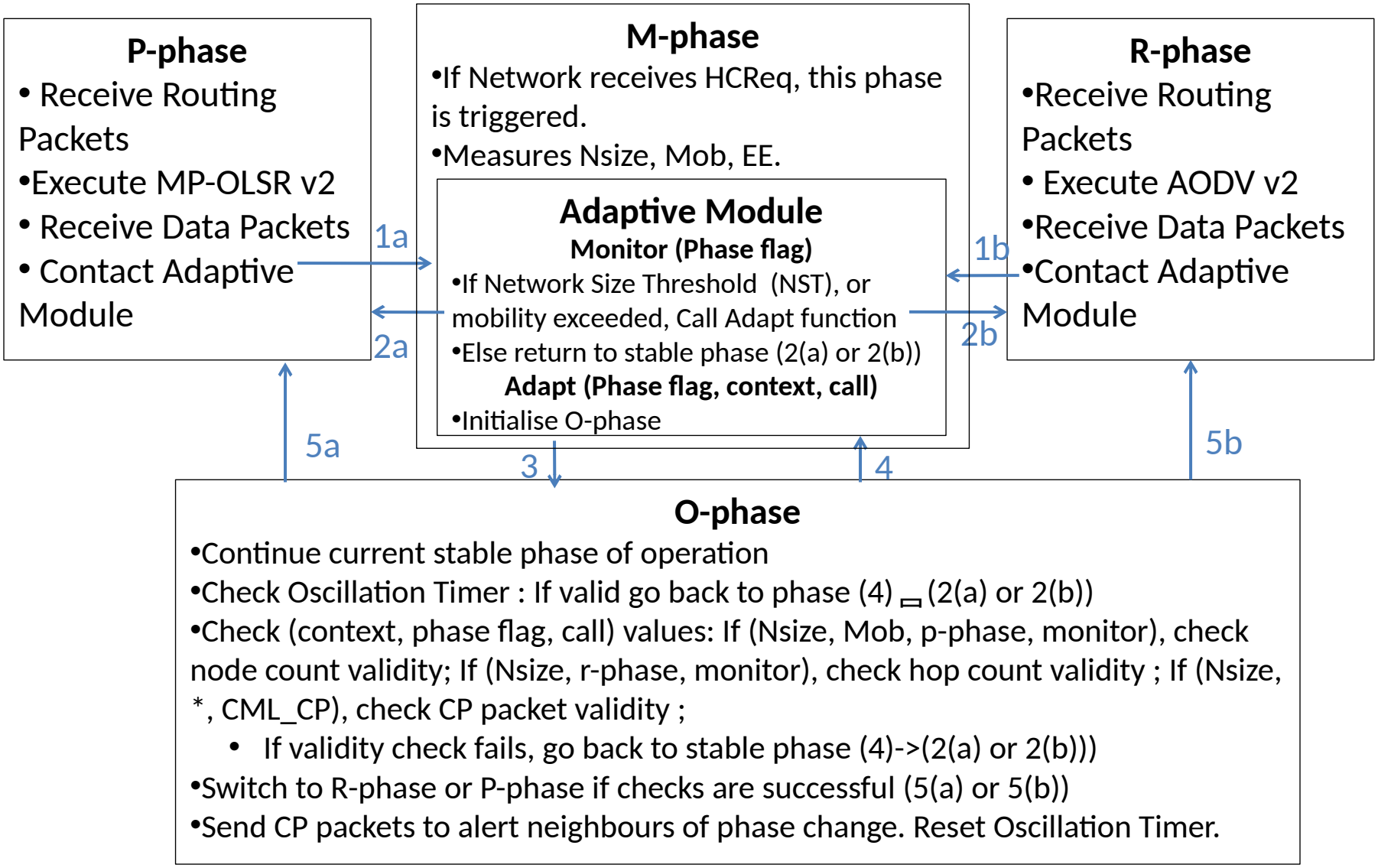
M-CML Overview (2)

- **Pre-requisite:** It has to create a set of network scenarios that is fit for particular routing protocols
- Four scenarios created by varying: Node density, node mobility, energy consumption, QoS requirements
- Through a series of simulation results, best routing protocols is identified for network scenarios
- Adaptive Module inside the node analyse the network scenario data and triggers the appropriate phase
- The M-phase runs within regular intervals so that it can track the dynamic nature of MANET

M-CML Overview (3)



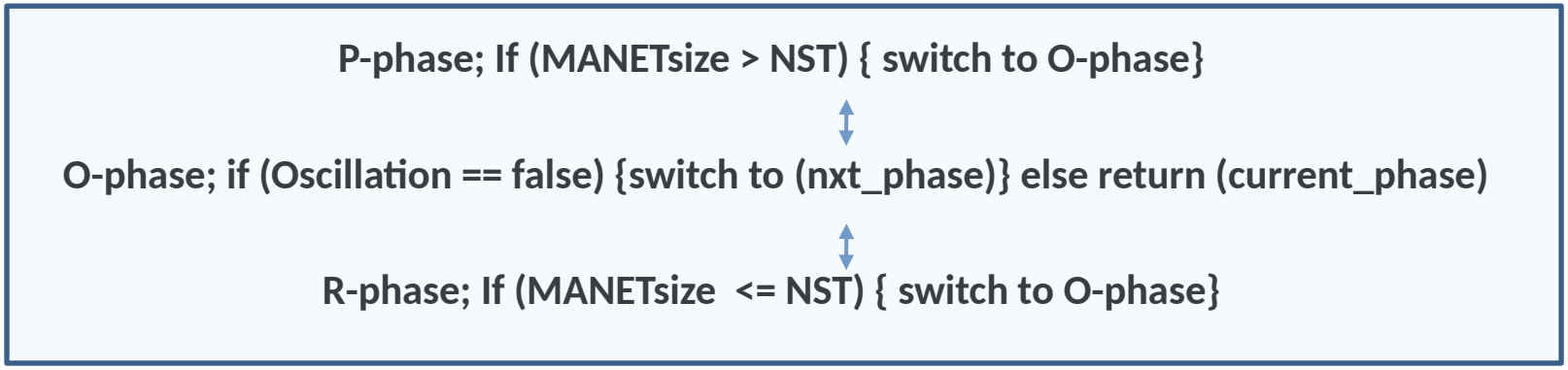
Algorithm


P-phase
• Receive Routing Packets
•Execute MP-OLSR v2
• Receive Data Packets
• Contact Adaptive Module
M-phase
•If Network receives HCReq, this phase is triggered.
•Measures Nsize, Mob, EE.
Adaptive Module
Monitor (Phase flag)
•If Network Size Threshold (NST), or mobility exceeded, Call Adapt function
•Else return to stable phase (2(a) or 2(b))
Adapt (Phase flag, context, call)
•Initialise O-phase
R-phase
•Receive Routing Packets
• Execute AODV v2
•Receive Data Packets
•Contact Adaptive Module
1a
2a
1b
2b
5a
5b
3
4
O-phase
•Continue current stable phase of operation
•Check Oscillation Timer : If valid go back to phase (4) ␣ (2(a) or 2(b))
•Check (context, phase flag, call) values: If (Nsize, Mob, p-phase, monitor), check node count validity; If (Nsize, r-phase, monitor), check hop count validity ; If (Nsize, *, CML_CP), check CP packet validity ;
• If validity check fails, go back to stable phase (4)->(2(a) or 2(b)))
•Switch to R-phase or P-phase if checks are successful (5(a) or 5(b))
•Send CP packets to alert neighbours of phase change. Reset Oscillation Timer.

Features

- Balance point between p-phase and r-phase:

  Considering Network Size Threshold (NST) as an example.



- Max. Hop count = Function (sqrt (Nt))
  - Monitor Function: Network Parameter Estimation
  - Adapt Function: call the O-phase with the necessary flags

- O-phase avoids group and periodic oscillations.

Future Directions

- In M-CMLv2, multipath version of the AODV. i.e., AOMDV, will be considered to make it fully multipath
- More Network scenario will be considered for routing protocols MP-OLSR and AOMDV to make it accurate transition
- The O-phase optimization will be taken into consideration to minimize the control packets during O-phase
- M-CMLv2 will be implemented with new link metrics .
- Contribute more by aligning our future work more closely to MANET WG charter.