

Component Based Performance Analysis for MANET

Routing Protocols

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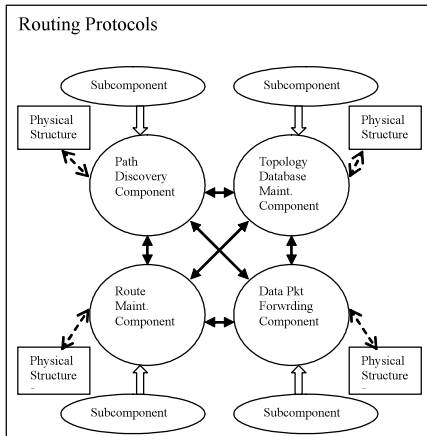
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Abstract

In consideration of adaptability to environment and flexibility in protocol construction, a novel Component Based Routing for MANET is presented. To facilitate quantitative analysis of Component's impact on overall performance, the innovative Component Dependence Network (CDN) is introduced here. Firstly, the hierarchical structure of CDN is proposed as a four-layer structure. And, each intermediate n th layer completely d -separate $(n-1)$ th layer and $(n+1)$ th layer. Secondly, Include-Exclude algorithm is introduced, and is illustrated by an example.

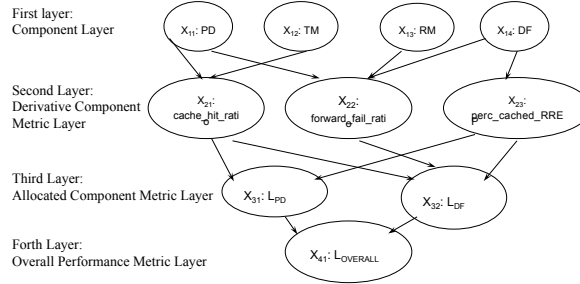
1. Architecture Of Component Based Routing Protocol

- Path Discovery Component (PD)
- Topology Database Maintenance Component (TM)
- Route Maintenance Component (RM)
- Data Packet Forwarding Component (DF)



2. Hierarchical Structure for Component Dependence Network

- Component layer
- Derivative Component Metric Layer
- Allocated Component Metric Layer
- Overall Performance Metric Layer



3. Determine the parent set for layer 3 variable: Include-Exclude algorithm

Including Phase:

Step1, initiate an empty evidence set $E0=\{\}$.
Step2, each time, include a new second layer variable $X2j$ to create new evidence set Ej , go to step 3.
Step 3, test if $Ind(X1i, X3k | Ej)=1$. If so, then stop the growing steps, and go to excluding phase. Otherwise, if $Ind(X1i, X3k | Ej)=0$, go back to Step 2.

Excluding Phase:

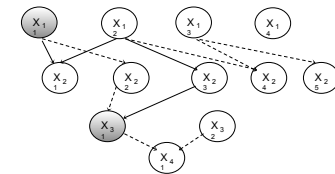
Step1, each time, delete a second layer $X2j$ variable from evidence set Ej to create new evidence set $Ej-1$. Go to step 2.
Step2, test if $Ind(X1i, X3k | Ej-1)=1$. If so, go to step 1, and continue to delete next second layer variable from evidence set $Ej-1$. Otherwise, if $Ind(X1i, X3k | Ej-1)=0$, go to step 3, When all second layer variables are deleted once from evidence set, go to step 4.

Step3, put back $X2j$ to evidence set $Ej-1$ to restore evidence set Ej . And go to step 1.

Step4, After all second layer variables are deleted once from evidence set to test the conditional independence, the minimal set for source destination pair $\langle X1i, X3k \rangle$, is returned. It's denoted as $E1(X1i, X3k)$.

Step5, Repeat step 1 to step 4, $E1(X1i, X3k)$ is returned at the end of each repetition. When $E1(X1i, X3k) = E1(X1i, X3k)$, the excluding phase is completed, and $cutmin(X1i, X3k) = E1(X1i, X3k)$

4. Example



Including Phase:

Initiate an empty set $E0=\{\}$
 Add in a second layer variable $X21$ to create new evidence set $E1=\{X21\}$. Because $Ind(X11, X31 | E1)=0$ (by independence test), continue Include Phase.
 Create new evidence set $E2=\{X22, X21\}$ by inserting new second layer variable $X22$. Since $Ind(X11, X31 | E2)=0$ (by independence test), continue Include Phase.
 Continue to insert second layer variable $X23$ into new evidence set $E3=\{X23, X22, X21\}$. Because $Ind(X11, X31 | E2)=1$, stop Include Phase, and go to Exclude Phase

Excluding Phase 1:

1. Delete $X23$ from $E3$, $E2=\{X22, X21\}$. Because $Ind(X11, X31 | E2)=0$, restore $E3=\{X23, X22, X21\}$.
2. Delete $X22$ from $E3$, $E2=\{X23, X21\}$. Because $Ind(X11, X31 | E2)=0$, restore $E3=\{X23, X22, X21\}$.
3. Delete $X21$ from $E3$, $E2=\{X23, X22\}$. Since $Ind(X11, X31 | E2)=1$, keep $E2=\{X23, X22\}$. And return $E1(X11, X31)=\{X23, X22\}$.

Excluding phase 2:

1. Delete $X23$ from $E2$, $E1=\{X22\}$. Because $Ind(X11, X31 | E1)=1$, return $E2(X11, X31)=\{X22\}$.

Excluding phase 3:

1. Delete $X22$ from $E2$, $E1=\{X22\}$. Because $Ind(X11, X31 | E1)=1$, return $E3(X11, X31)=\{X22\}$. Since $E3(X11, X31)=E2(X11, X31)$, Excluding Phase is stopped. And $cutmin(X11, X31) = E3(X11, X31)=\{X22\}$.