Wireless Communication Project
Distributed resource allocation for hybrid networks
Report 2

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Abstract

This is not a formal article.
In this report, we talk about aim of the project, methods we will use in this project to approach better performance and maximize utility of users, assumption on which our model based, and characteristics and related factors of cost/utility function a node used to compare and select access to other part of network. Cost/utility function and their related factors are analyzed, but still undetermined

1 Aim of project

Aim of this project is to devise a distributed resource allocation mechanism in a network in which every node is responsible for comparing and making decision among its own network access/routing candidates. And the result of "local" decisions that make up structure of local network could make use of capacity of whole network fairly and effectively.
Programs or scripts will be written to simulate network to assure its validity later.

2 Glossary

- Node: Electronic device attached to network.
- Neighbour node: If nodeA and nodeB can be connected directly without forwarding, we say nodeB is neighbour node of nodeA, and vice versa.
- Resource: access to content and related network service.

- Allocation: bind portion of available resource to one node, enabling node to access whole network through given capacity of connection.
- Network: A group of interconnected nodes. Its structure changes dynamicly, for nodes may connect/disconnect at any time.
- Hybrid network: In hybrid network, a node is able to access more than one network simultaneously. This enables "vertical handoff" feature, which can be make use of to improve performance of node and work.
- Distributed: a node is responsible for inquiring neighbour nodes for available access to non-neighbour nodes, comparing among routings, and choice one routing to access whole network for each service.

3 Assumption and prelimanary analysis

To make modelling process concise and without too much loss of generality, assumption listed here are used to build a brief model and guide later simuliaton:

1. We split the whole imagionary network into two halves: "local network" and "extern network".
2. Nodes may connect to local network and disconnect from local network at any time indepently and randomly.
3. Major object of study is local network. And the mechanism we are developing is only used in local network.
4. In local network, there is no "content providers". Therefore when one bidirectional connection is initiated, its one end must be in local network, and the other end must be in extern network.
5. There are interfaces between local network and extern network. The interfaces have different bandwidth and latency.

Because of the assumption, the consequent analysis and simulation in this project is supposed to fit better with smaller hybrid network, which contains less contents.
Based on the assumption, we will develop the mechanism that every node of local network used to connect to each other and extern network.
To compare among different routings in local network, we use cost/utility function.
To judge whether a mechanism is valid and effective, we will simulate the situlation and calculate:

- operation factor of network capacity (bandwidth between local network and extern network) during a long period of time
- utility of each node

4 Analysis of cost/utility function

Cost/utility functions are used to evaluate different routings to another node. Ther are calculated when node is to initiate new connection, or existing connection can not keep because structure of network changes.
Based on result of evaluation, node can pick a routing and connect to other nodes. The aim is to maximize utility and minimize cost(if possible), or get an acceptable trade-off between cost and utilization(if necessary).

In our current modelling, cost function of one routing for a connection is used to be determined by:

- extra power required to connect and maintain connection, related with signal power and connection type.
- amount of electricity remained in mobile device. (If battery has little energy, cost will be high, and if device is connected to power supply, the power factor will has a tiny weight in function).
- extra processor time required.

And utility function is determined by:

- type of data to be transfered (The same connection property can lead to different utility when they are used to transfer different type of data. For example, latency and in real-time voice/video communication will have high weight, and bandwidth in download
- latency
- bandwidth
- stablity
- current resource operation ratio of every node on the routing. This can help balance load of network.

NOTE:This is not final version of cost/utility function.

5 Summary and prospect

In this report about our current research, we talked about the aim of project, assumption we used in model a hybrid network, and some prelimanary analysis about cost/utility function. We will continue to develop and improve that.
As mentioned in abstract and chapter "Aim of project", we will develop the model, use program or script to implement simulation, and improve our modelling in return.

References

We are sorry to say references list are not prepared yet. Full list of references will be listed in later reports.