Virtual Operator based AAA in Wireless LAN Hot Spots with Ad-hoc Networking Support

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Outline

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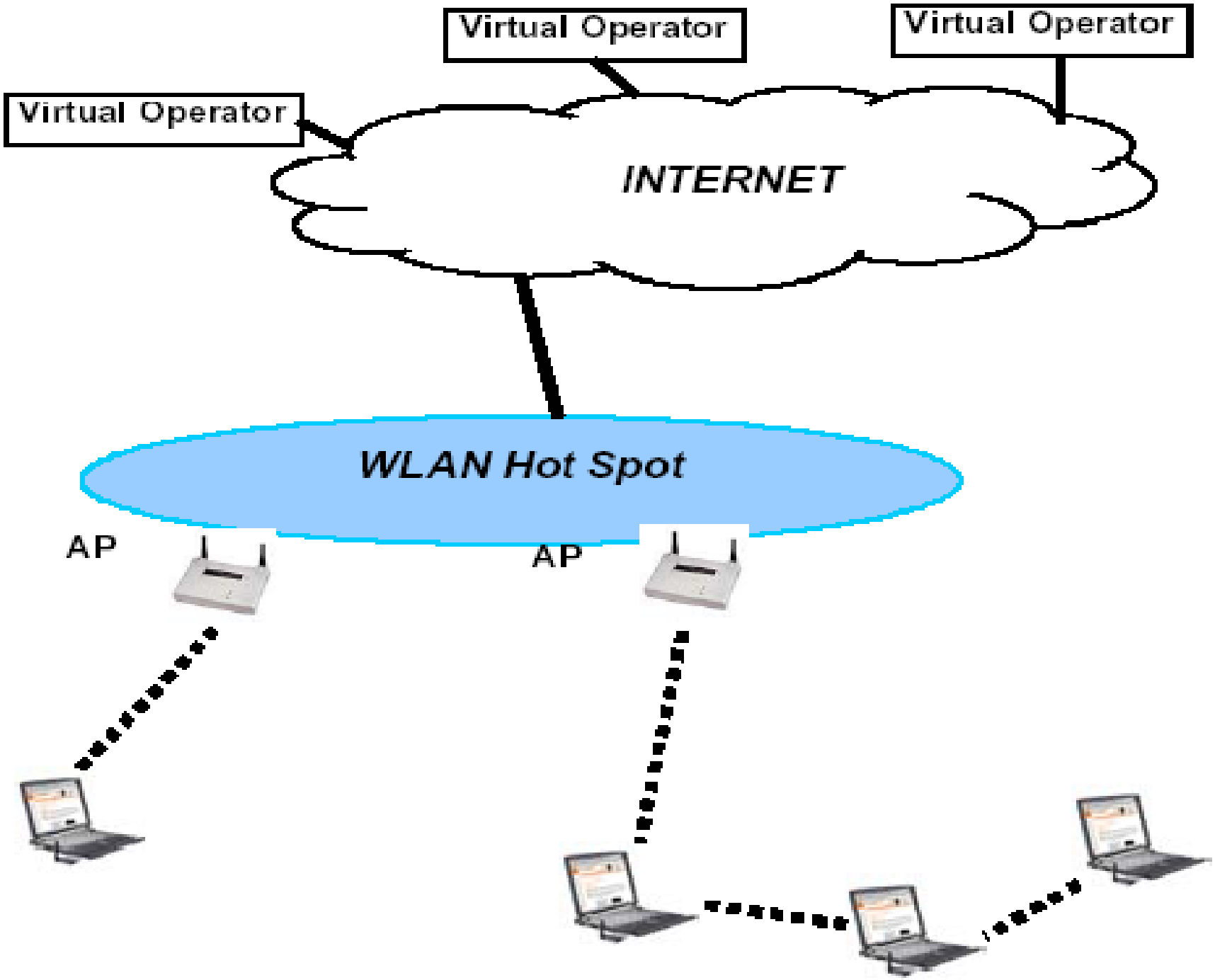
- Solutions
- Authentication
- Accounting
- Broker model
- Conclusion

Introduction

- Wireless LAN access points (AP) are starting to be deployed in public hot spots for public Internet access.
- To ensure the proper operation under this model, it is critical that Authentication, Authorization and Accounting (AAA) be done.
- It is inconvenient if a mobile user has to maintain an account with each WLAN provider.


Virtual Operator
Virtual Operator
Virtual Operator
INTERNET
WLAN Hot Spot
AP
AP

Virtual Operator

- Uses the mobile users' service providers as the single point of contact for AAA transactions.
- A service provide that has a contractual relationship with the Wireless LAN provider.
- It's possible for a single user to have an account with each WLAN provider.
- The solution is entirely based on IP.
- A packet filtering function employed at an AP, similar to the firewall function.

Types of Virtual Operators

- Internet Service Providers
- Cellular operators
- Pre-paid card provider

Current solutions

Cisco

- Uses IEEE 802.1X and EAP to provide a virtual link between the access point and the mobile terminal.
- The solution is not backward compatible.
- Key exchange problem.

  All session keys between the MTs and the APs are assigned by the authentication server.

Lucent

- Uses the RADIUS protocol.
- Mutual authentication is not considered.
- Diffie-Hellman algorithm is prone to “man in the middle” attack.

Nokia

- Announced their “Operator Wireless LAN” solution.
- Each wireless LAN card has an integrated SIM card reader.
- RADIUS protocol is used between the public access controller and the GSM authentication and billing gateway.
- The solution only targets cellular network based virtual operators.

Web Browser based approach

- The authentication process are carried out in the web browsers on the client machines using the secure HTTPS protocol.
- The access control mechanism is not secure .

  The browser can not perform any key configuration on the client machine after the authentication.

Solution

- The entire AAA process is carried out over the IP layer.
- Based on filtering function.
- AP controls the authentication, which includes the establishment of the authentication channel, the controlling mechanism, and the session key assignment and management mechanisms.
- A gateway between the AP and the network to control the MT access and to relay the AAA messages.

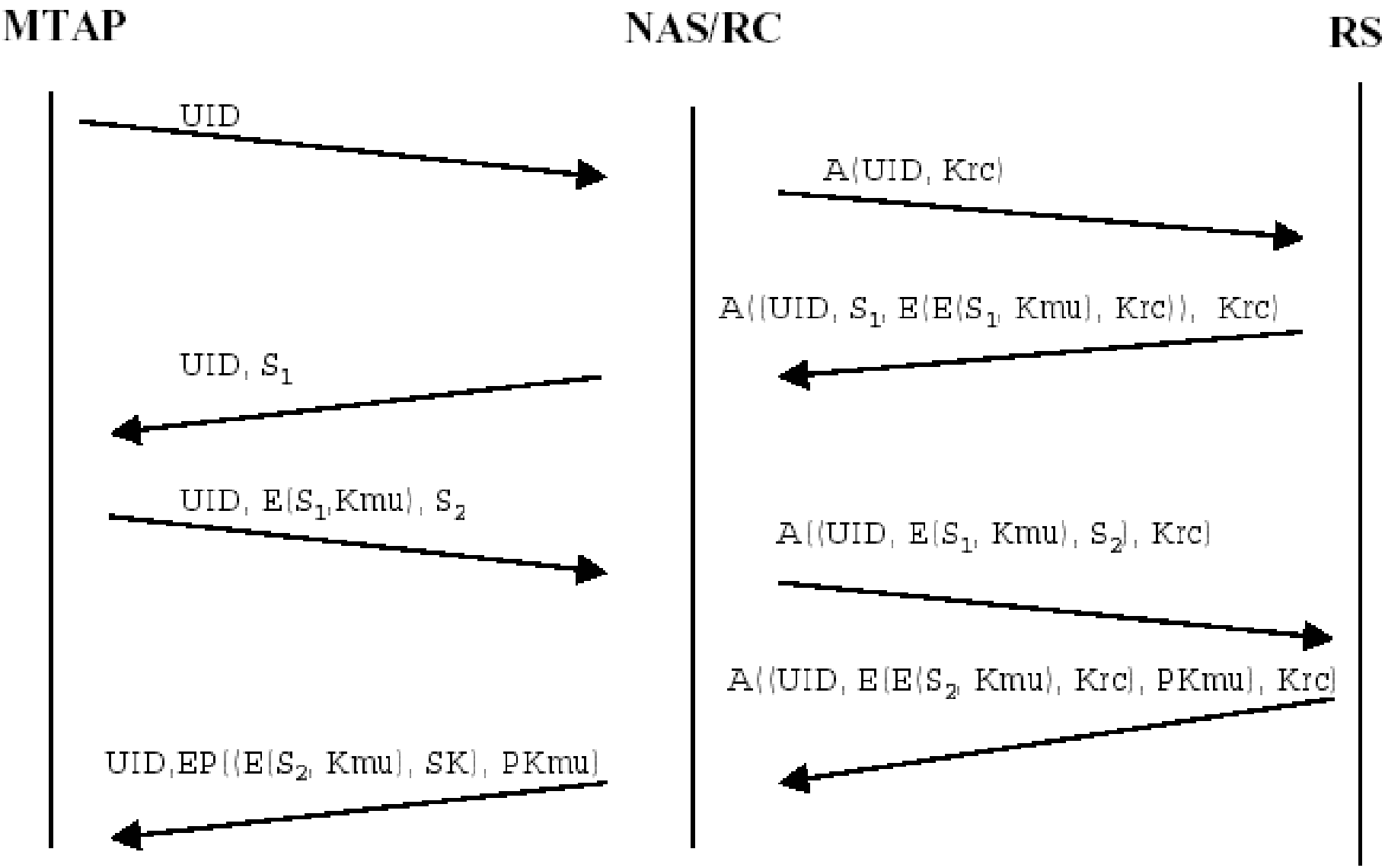
Benefits

- Works over different air interfaces.
- It does not require modification to layer 2 protocols.
- Since encryption can be done at the IP layer using IPSEC, it does not require that the AP support layers session keys.
- It supports ad-hoc networking without any protocol change.

Authentication and Authorization

- Allows APs to determine session keys and communicate them securely to the associated MTs.
- Each authenticated user has a shared session key with the AP.
- AP filters the IP addresses and authenticated user traffic with the session key.

Authentication Procedure



Fast AAA handoff

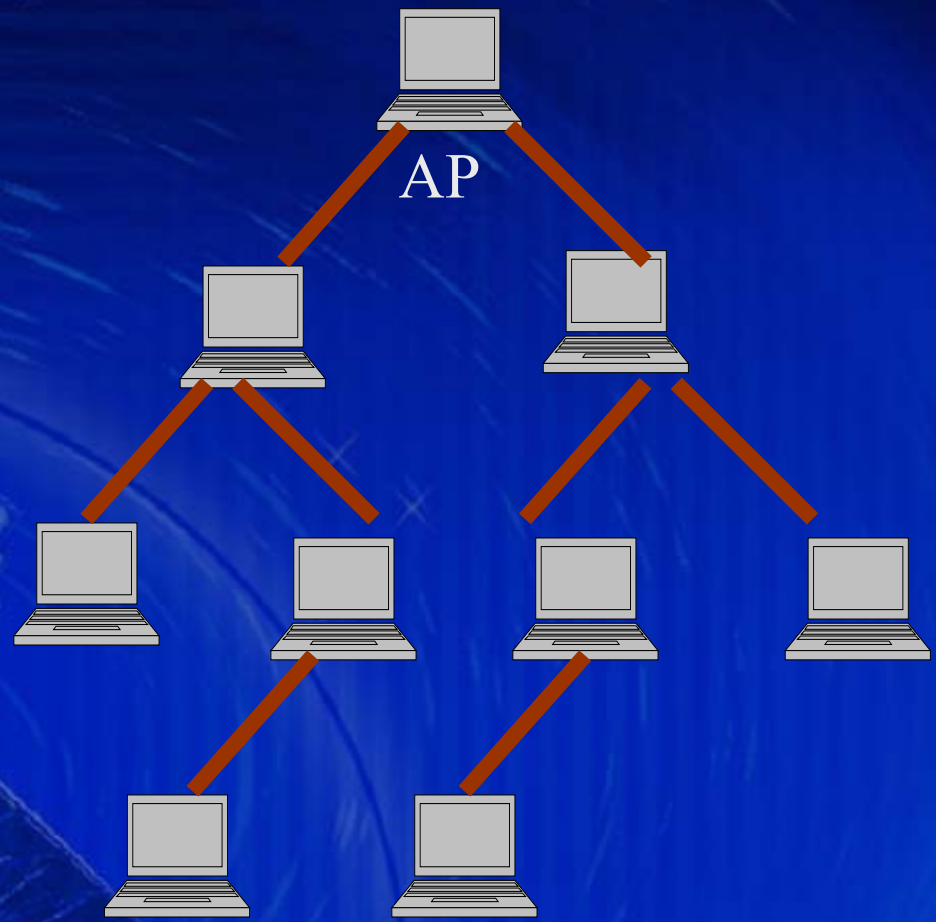
- The user does not have to go through the authentication process all over again.
- New AP contacts the old AP, notifies the old AP and fetches the user profile.
- The new AP then encrypts the new session key it shares with the user together with the old session key using the user's public key.

Accounting

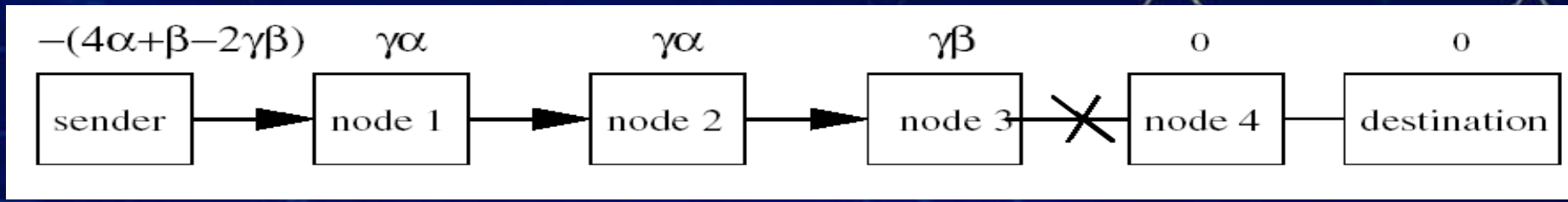
- Using mutual accounting proof from both the mobile users and the wireless LAN operators.
- A traffic monitoring module on the MT monitors wireless LAN traffic, and sending usage profile to the AP.
- AP checks the usage profiles, if match, send profile to Virtual operator.
- Virtual operator has the proof that user and WLAN operators agree on the usage profile.

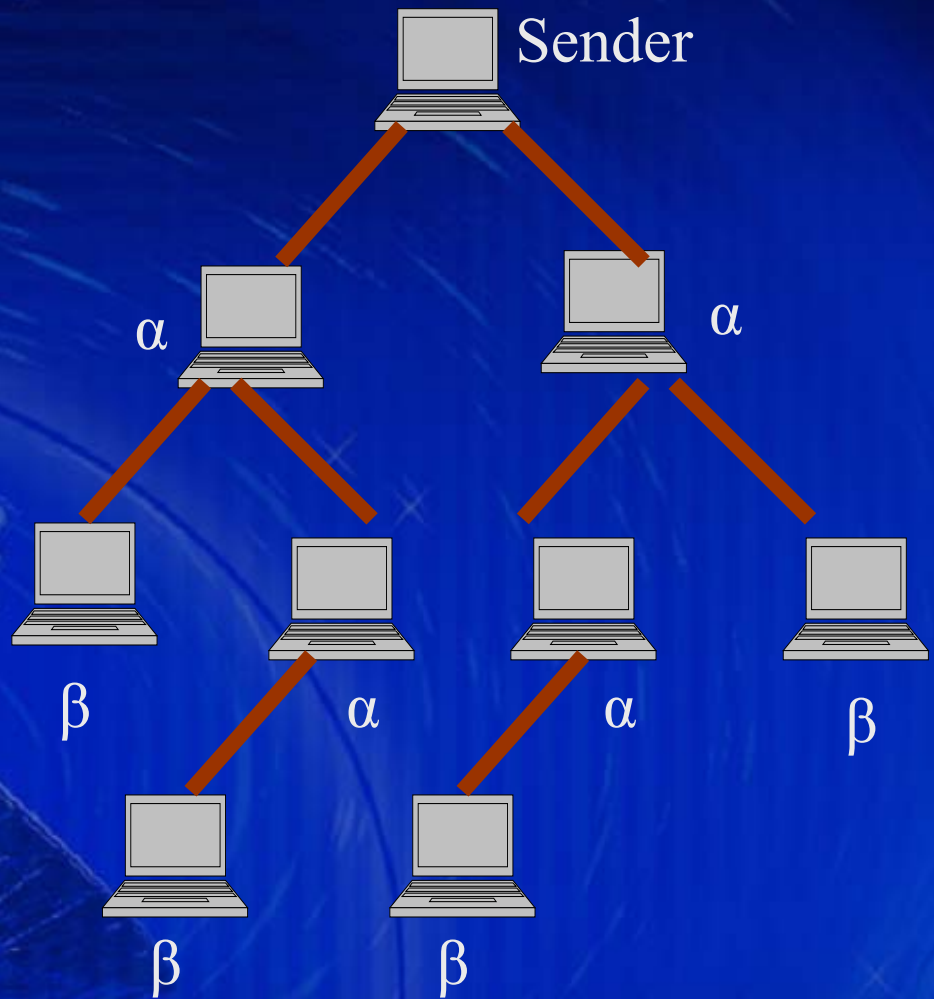
Ad-hoc network accounting

- Minimum spanning tree rooted at the AP.



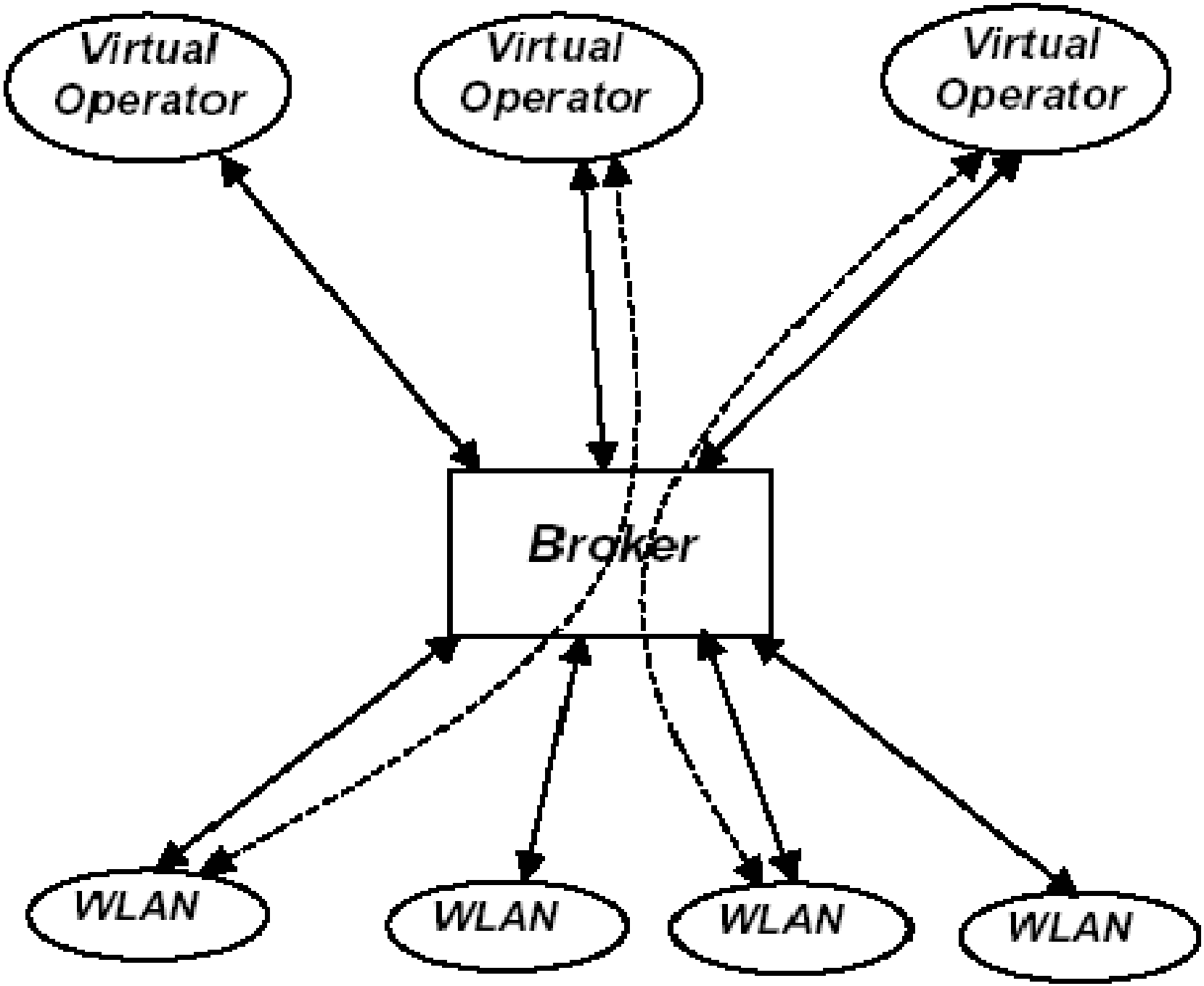
Sprite


−(4α+β−2γβ)
γα
γα
γβ
0
0
sender
node 1
node 2
node 3
node 4
destination


Sender
α
α
β
α
α
β
β
β

Broker

- Each wireless LAN operator and virtual operator pair with a business agreement need to establish a trust relationship.
- AAA proxying and dynamic relationship set-up.
- Once the relationship is established, all the AAA transaction will be carried out through the direct communication channel between the WLAN and the virtual operator.


Virtual Operator
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Conclusion

- Virtual Operator is a very useful concept in providing public Internet access with wireless LAN technologies.
- In a public access LAN environment, a diverse set of wireless products and different types of wireless operators may coexist to provide mobile users with convenient and comprehensive wireless access solutions.