802.16e Security Motivations and Needs

IEEE 802.16 Presentation Submission

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Purpose:

To illuinate the issues and requirements for 802.16e security Adhoc.

802.16e Security Adhoc Motivations and Needs

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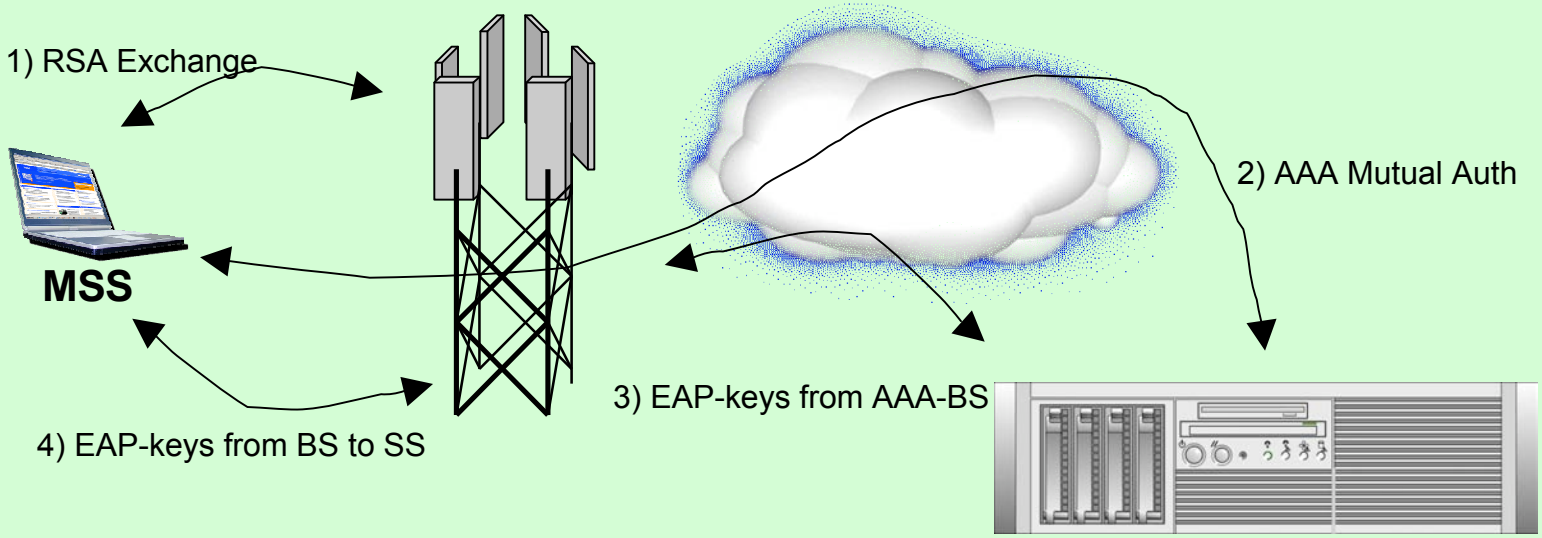
Authentication Model



- Two authentications – Cert exchange & EAP
  - Two sets of keying material
- Ultimately leads to keys to protect link traffic

- Are we agreed on this model??

Why?

- Device authentication
  - Verify that the device is OK
    - WiMax Certified, employer issued, Operator issued
- User authentication
  - Verify that the user is OK
    - Is a user that has paid the bill
    - Is a legitimate user – employee, guest, etc.
- Confidentiality
  - Protect privacy, defend against theft of service, forgery & replay
- System Stablility
  - Protect the provision of service from DoS
- System Performance
  - Fast Handover
- Dual Authentication
  - Verify that connection is from a legitimate user, using legitimate equipment
  - Very flexible model
    - Model varies depending on who is CA

What it is not

- End to End security
  - We are securing the link and the data on the link
  - We are not protecting data once it has left the BS into the network
- An attempt to do ‘pure’ security
  - Would not involve EAP or X.509
  - We are following industry norms
- Secure from government snooping
    - Would need 512 bit keys, layered crypto algorithms, non-FIPS, very costly.

Basic Approach

- I think that we all are following certain ways of doing things..
  - RSA key agreement/mutual authentication
  - EAP key agreement/mutual authentication
  - Derive keying for key transfer
  - Timely key updates
  - Out of band security protocol

- Is this true?

What if we don’t amend PKMv2?

- Reluctance on operator deployments
  - Want secure basis for billing
  - Want seamless handover for voice
- Reluctance for users to deploy
  - Theft of service
  - Privacy violations
- Reluctance for campus deployments
  - Same as for WEP

Current Security Problems

- Certificate exchange
  - Not mutual
  - Uses X.509 (ugh!)
- Fast Handover
  - No support
- Key Hierarchy
  - No support for EAP keys
- EAP Messages not protected
- Key Exchange
  - Forgery attacks, MITM attacks
  - No EAP key exchange

Current Security Problems

- Authorization state
  - No AAID to distinguish authentication instances
- DES Insecure
  - Poor IV construction
- No management message protection allows DoS and EAP weakness
  - De-register messages, PKM messages etc.
- Inter BS, Inter operation handover performance
  - Tradeoff between security and on-air bandwidth consumption

Current Draft Text Problems

- Protocol Version Number
  - Not tied to any text
    - .16e is current amending the .16d PKMv1 text!
- Authorization Policy Negotiation
  - Is being confused with PKM version negotiation
    - {EAP, mutual auth, good keying} == PKMv2
    - {!EAP, one way auth, bad keying} == PKMv1
- DES Endianess Ambiguity
- No version 2 state machines
- No vectors – Impossible to be interoperable

Technical Approaches

- DJ (Intel) PKMv2
  - Restricted crypto primitives (AES, RSA)
    - Nice for HW
  - Complete Key hierarchy
    - Group key separation
    - EAP-key & PAK binding
  - Fast Handover
    - Pre-Auth (BSID addressed PKM messages)
    - Authorized Association state
  - Mutual Certs with key liveness checking
  - EAP 4 way handshake

Technical Approaches

- Jeff (Streetwaves)
  - PKM-EAP messages
  - EAP messages 4 way handshake
  - Fast Handover
    - PMK Caching

Technical Approaches

- ? (Samsung)
  - Secured PKM packets
  - Map BS EAP to PKM-req and SS EAP to PKM-rsp
  - Individual Negotiation for RSA and EAP exchanges
    - Auth Policy Support
  - MBS service crypto (above ARQ)
  - Crypto Synchronized MAC for Mgmnt frames

Technical Approaches

- Donnie Lee (SK Telecom)
  - Map BS EAP to PKM-req and SS EAP to PKM-rsp
  - EAP-Success ACK with PKM message
  - Auth Policy Support
    - Between old and new protocols

New Work

- Define AES based KDFs
- Define MBS <-> GAK link
- GAK Key Transfer
  - Decision : Unicast, Multicast or Both?
- Fast Handover
  - Decision : PMK Caching or Pre Auth or Transfer of derived keys?
- Draw State Machines
- Test Vectors

Proposal Merging