802.16e Security Motivations and Needs

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Purpose:
To illuminate the issues and requirements for 802.16e security Adhoc.

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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 Stability**
  - 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