

Mobile IP versus IPsec Tunneling with MOBIKE: A Comparison Under Wireless Vertical Handover

Chris Kilgour
ENSC 835 Project
April 2011

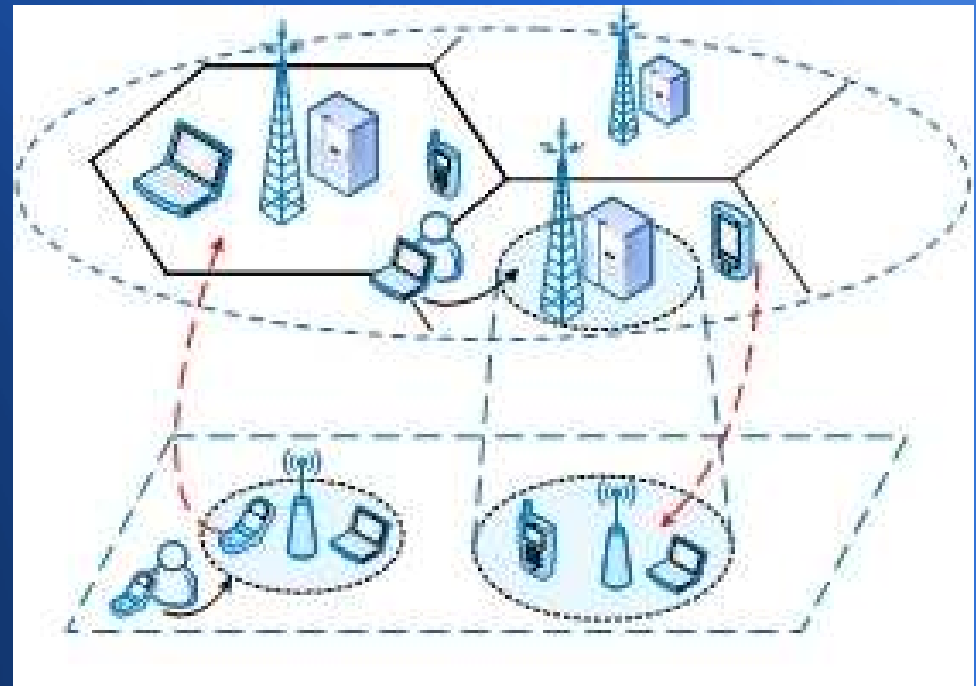
Agenda

- Motivation
- Tunneling Technologies
 - Mobile IP
 - IPsec
- NS-2 Simulations
- Conclusions

Motivation

Smart Phones And Tablets

- Mobile internet devices are popular
- Streaming internet applications do not tolerate data drops
- Data drops can occur during vertical handover

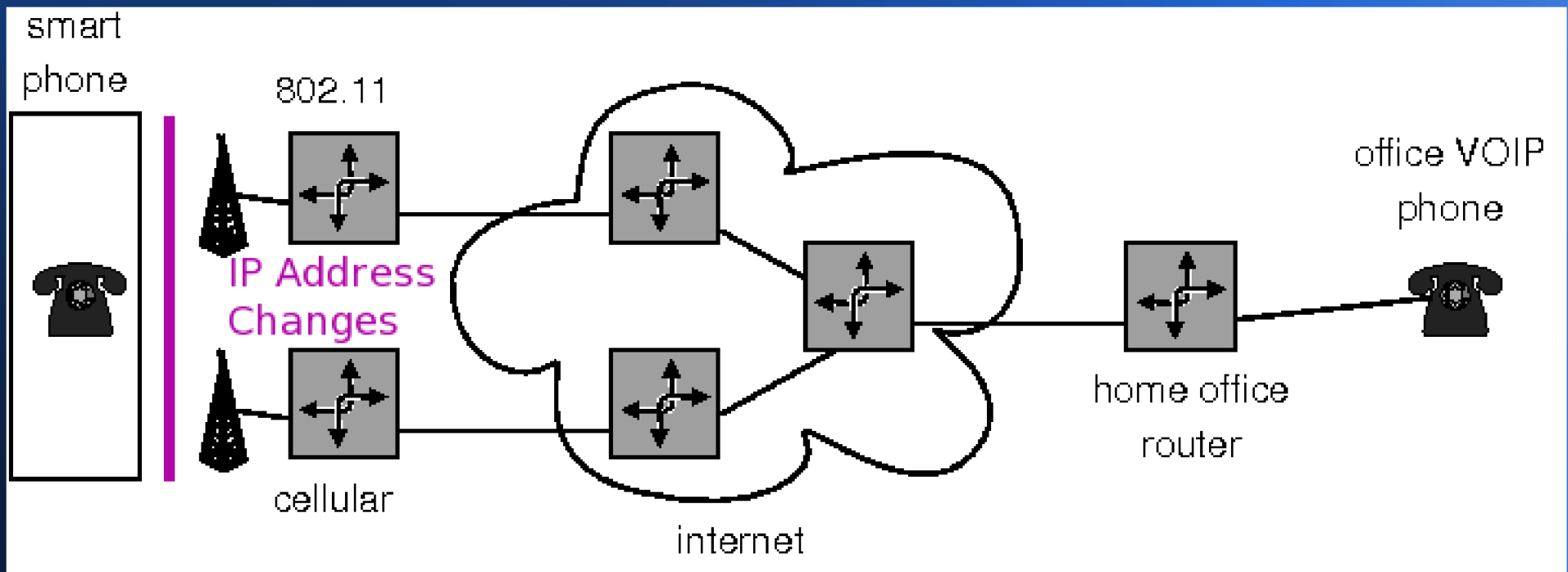


The Big Question

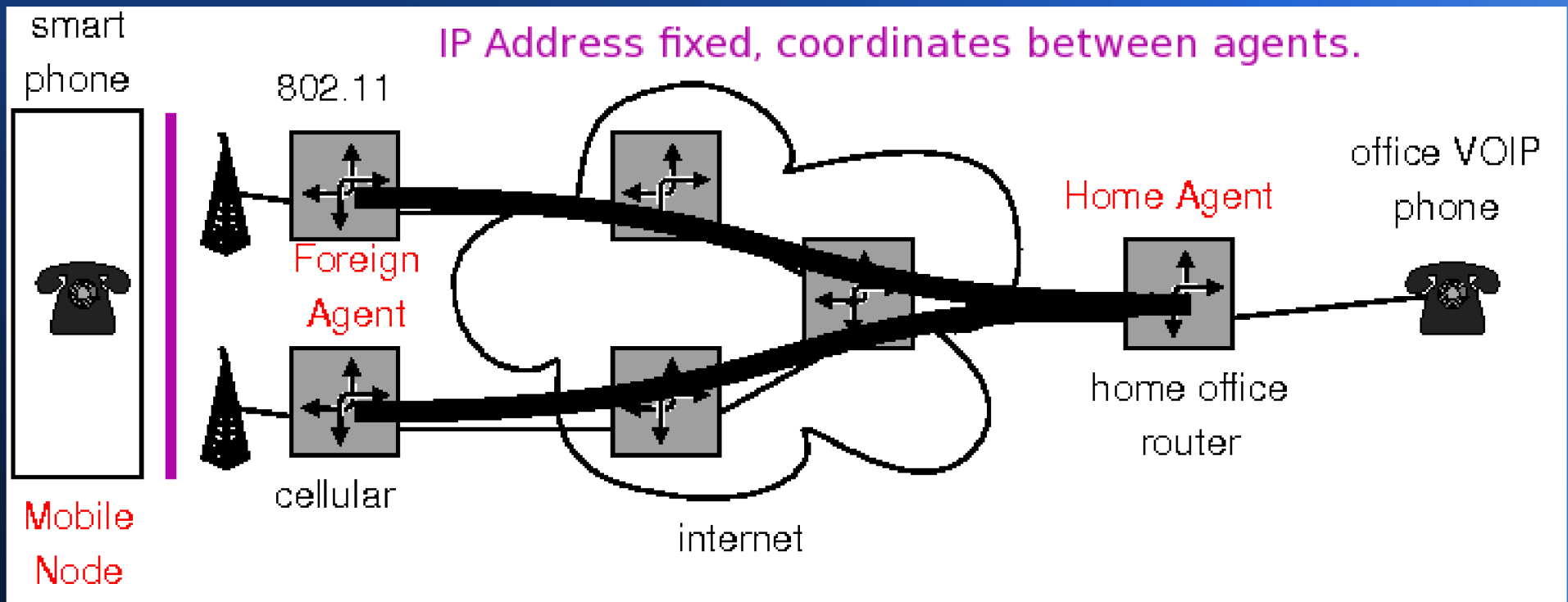
Is seamless vertical handover possible?

Tunneling Technologies

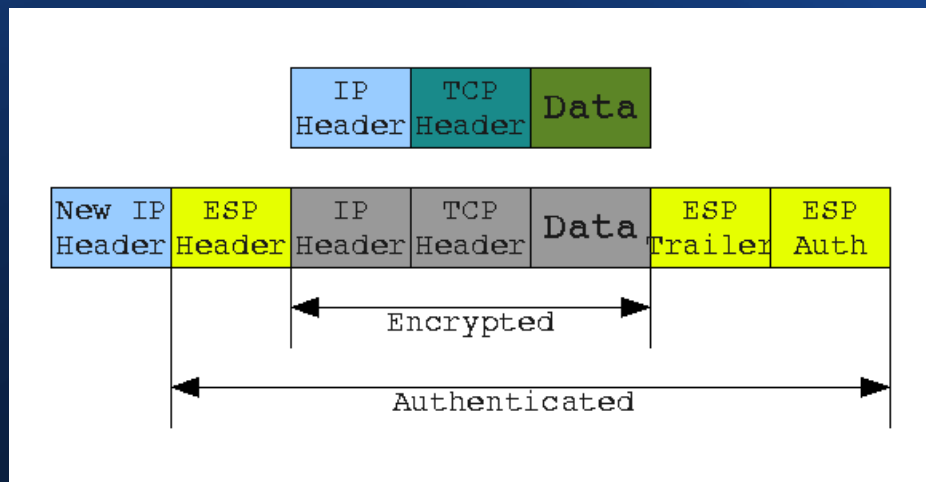
IP Mobility Fails Without Tunneling



Mobile IP

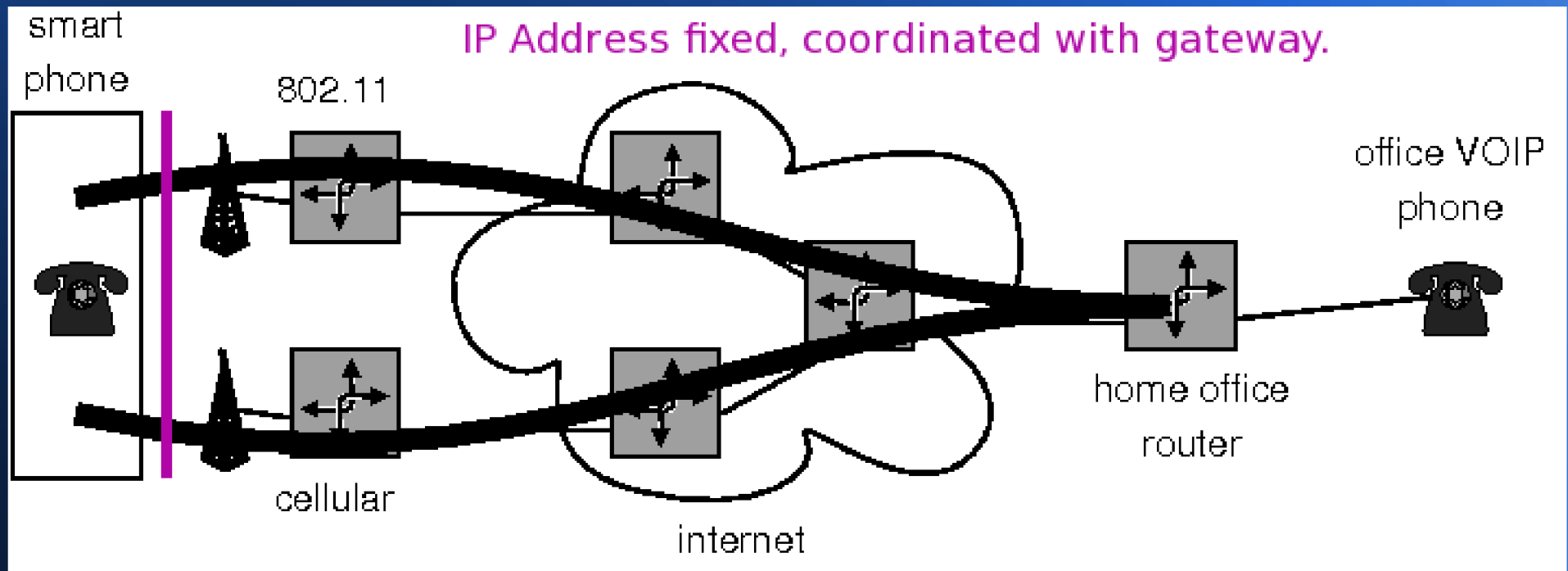


IPsec In A Nutshell



- Additions to the Internet Protocol suite
- Cryptographically protected headers and payload
- Provides compression and IP-in-IP tunneling

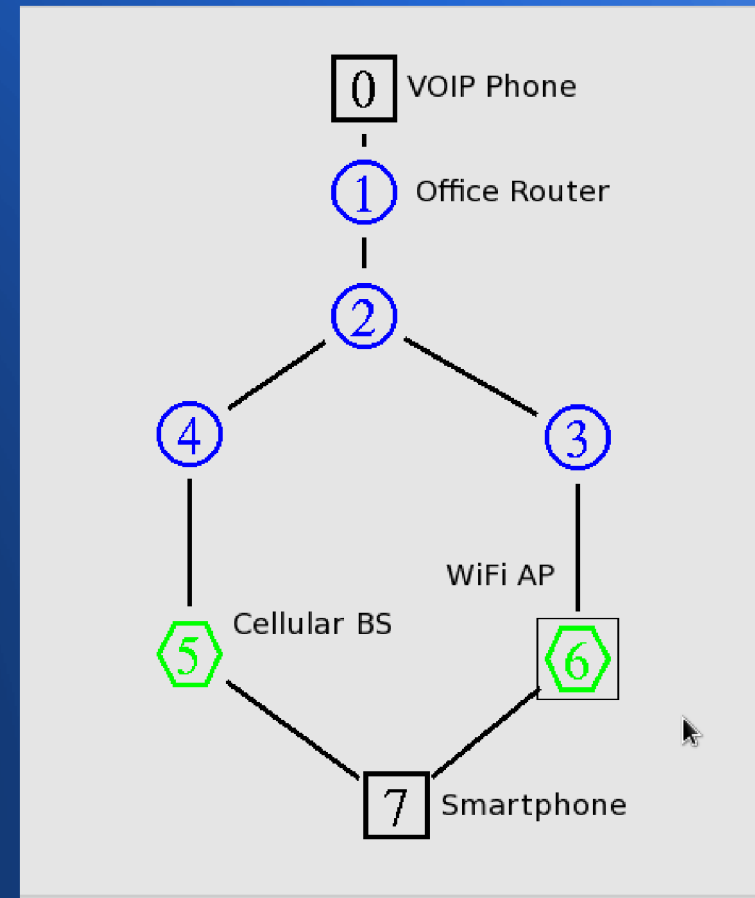
IPsec Tunneling



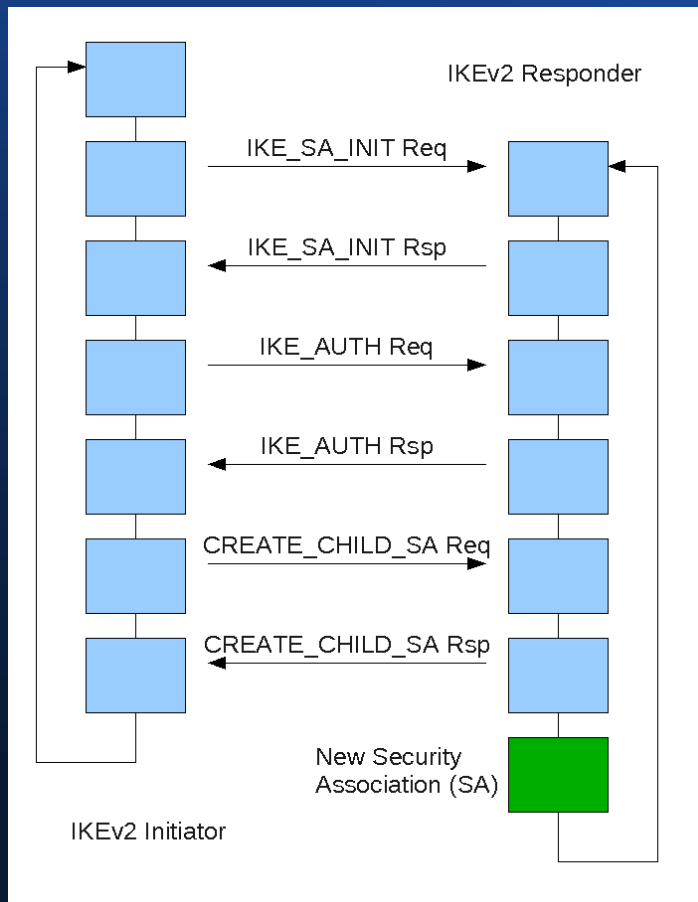
Simulations

NS-2 Simulation Approach

- Use existing Mobile IP support
- Create a custom Internet Key Exchange (IKEv2) Agent
- Model cryptographic functions as extra processing delays

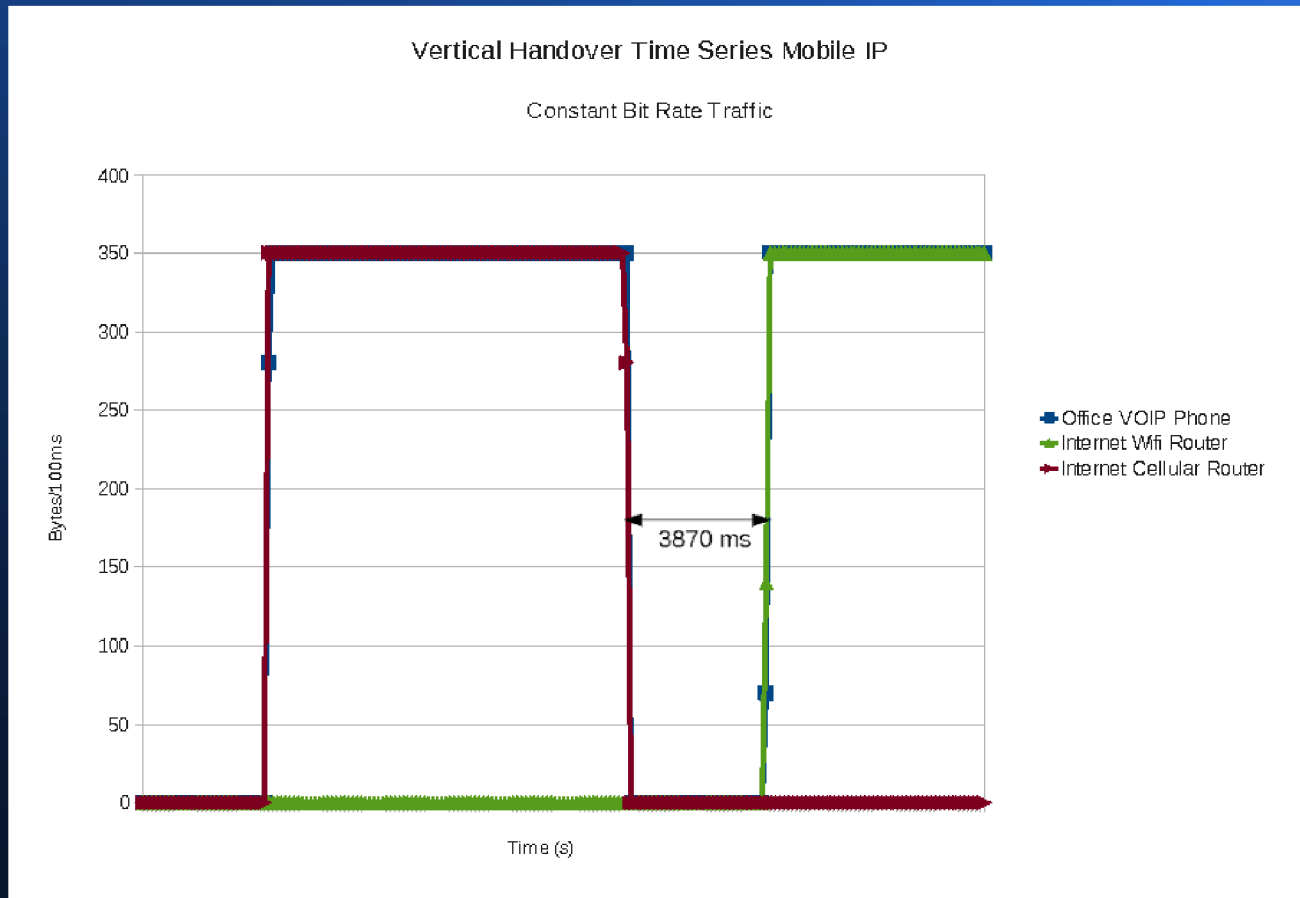


IKEv2 Initiator And Responder

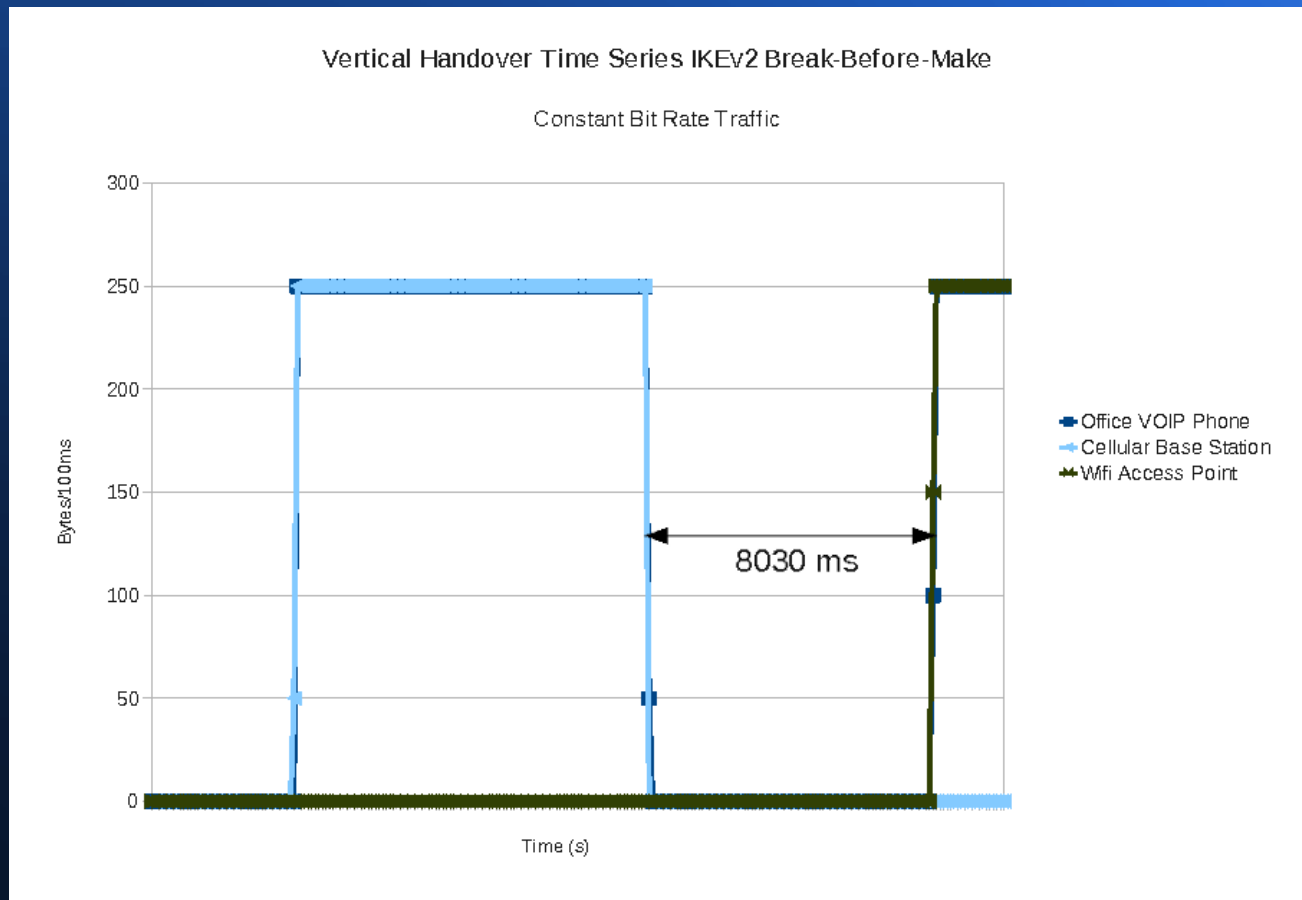


- IKEv2 exchanges carried over UDP
- 500ms retransmission
- Six exchanges required to establish a security association
- Implemented as NS-2 Agents

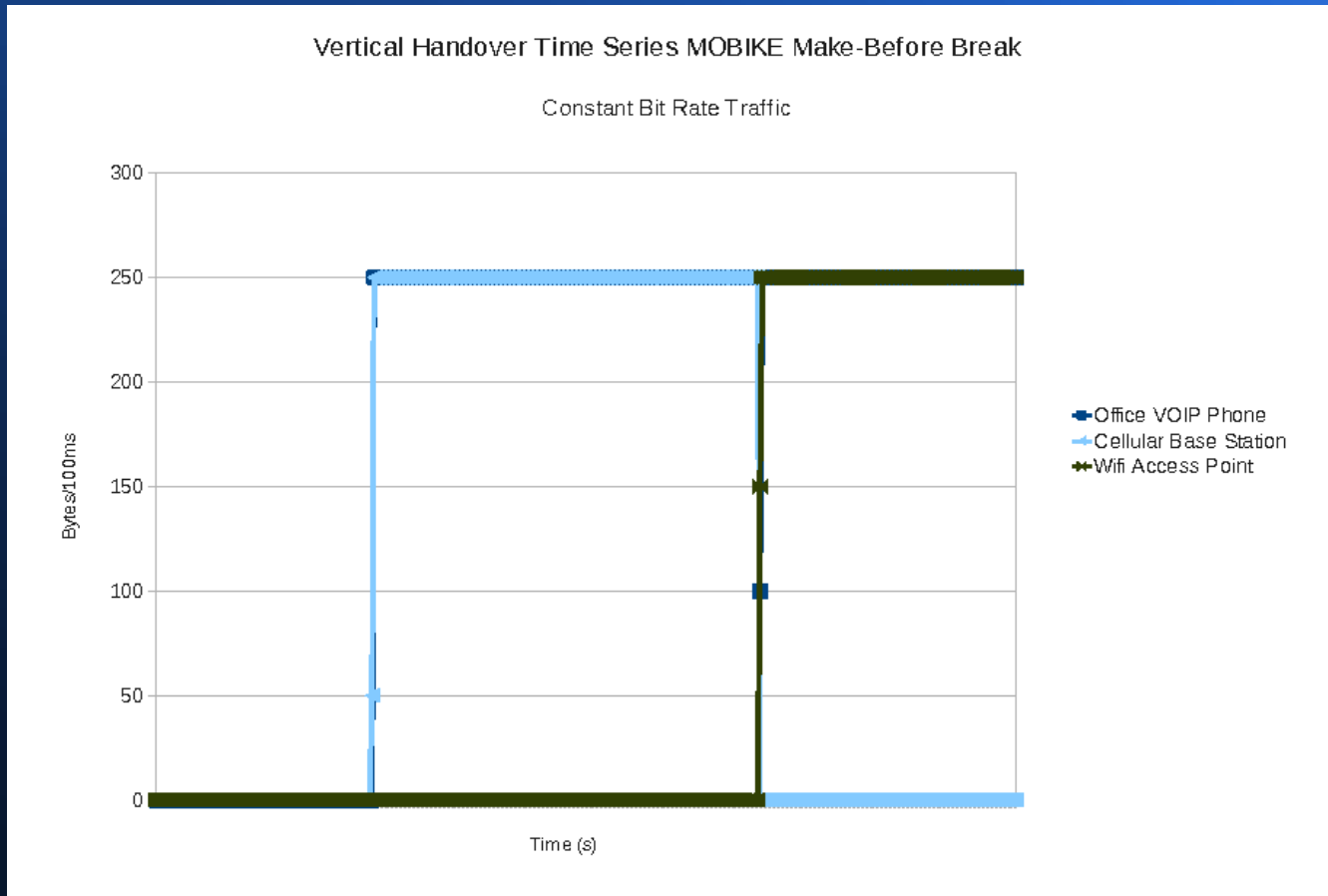
Mobile IP



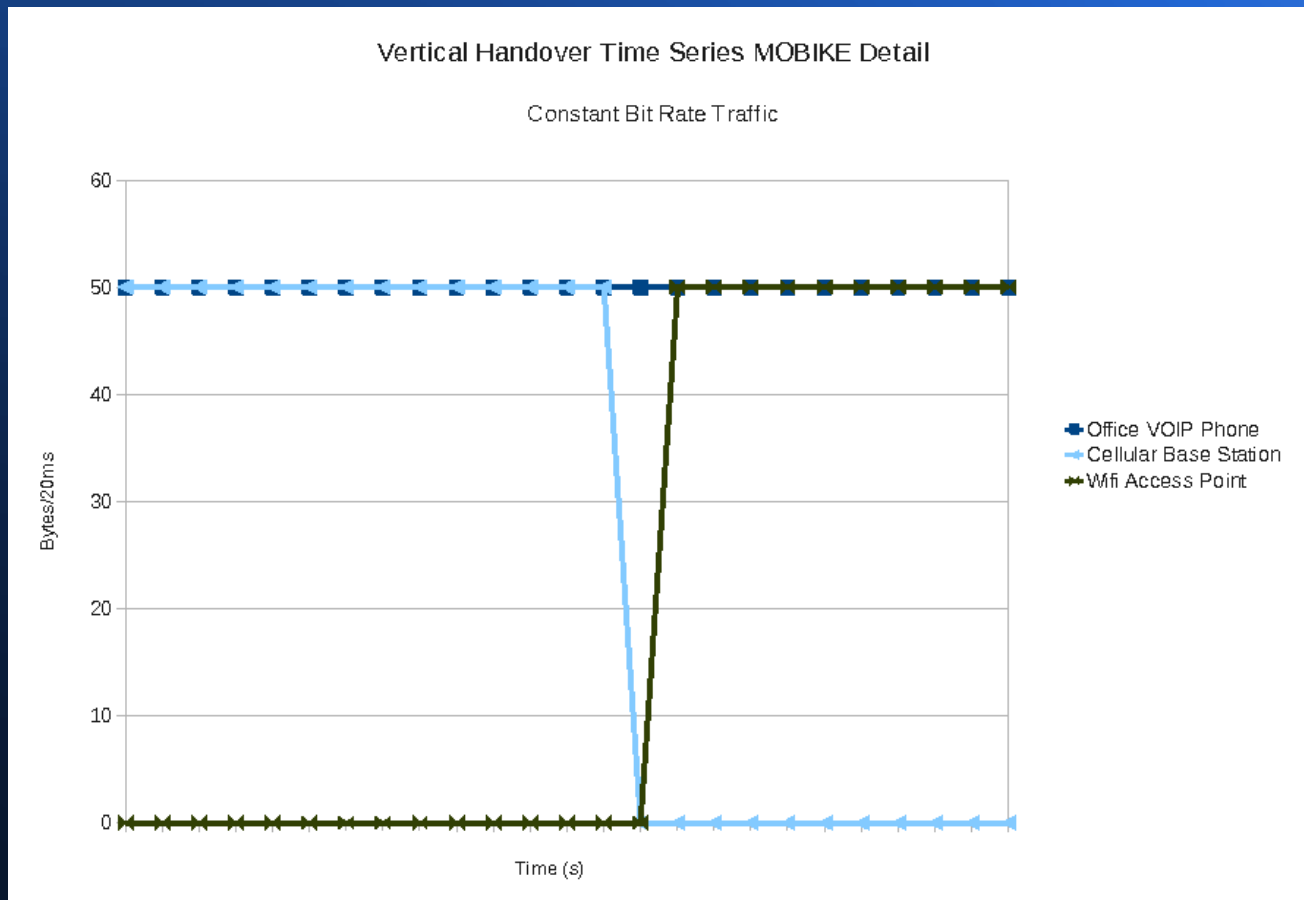
IPsec IKEv2 (Break Before Make)



IPsec With MOBIKE (Make Before Break)



MOBIKE Handover Detail



Vertical Handover Data Loss

IP Mobility Strategy	Data Loss Period During Vertical Handover
Mobile IP	Approximately 3 seconds
IPsec tunneling with IKEv2	Approximately 8 seconds
IPsec tunneling with MOBIKE make-before-break	No data loss

Improvements And Future Work

- More detailed and complete implementation of IKEv2 and MOBIKE
- Add IP-in-IP representation of IPsec for tunnels
- Allow model parameters to adjust for selected security and cryptographic settings
- Integrate with multiple interface support in NS-2
- Integrate further with wireless support in NS-2

Conclusions

Seamless Vertical Handover Is Possible

- Tunneling can provide IP address mobility
- Mobile IP and earlier generation VPN tunnels have significant data drops during vertical handoff and expose security risks
- *IKEv2 Mobility and Multihoming Protocol (MOBIKE)* can provide seamless, make-before-break vertical handover
- IPsec extra benefits: security and compression

References

- [1] J. Caldera, D. de Niz, and J. Nakagawa, "Performance Analysis of IPsec and IKE For Mobile IP on Wireless Environments", Information Networking Institute, Carnegie Mellon University, 2000
- [2] S. Itani, "Use of IPsec in Mobile IP", Engineering Term Paper, American University Of Beirut, Lebanon, 2001
- [3] X.P. Costa and H. Hartenstein, "A simulation study on the performance of Mobile IPv6 in a WLAN-based cellular network", *Computer Networks*, vol 40, pp191-204, 2002
- [4] X.P. Costa, M. Torrent-Moreno, and H. Hartenstein, "A Performance Comparison Of Mobile IPv6, Hierarchical Mobile IPv6, Fast Handovers for Mobile IPv6 and their combination", *Mobile Computing and Communications Review*, vol 7, no 4, 2004
- [5] T. Janevski, "Analysis of Mobile IP for NS-2", *16th Telecommunications Forum TELFOR 2008*, in Belgrade, Serbia, November 2008
- [6] Q. Qui, D. Zhang, J. Ma, "GPRS network simulation model in NS-2", *Communications, 2004 and the 5th International Symposium on Multi-Dimensional Mobile Communications Proceedings*, 29 August – 1 September, 2004
- [7] A. Gurto, S. Floyd, "Modeling Wireless links for Transport Protocols", *ACM CCR*, 34(2):85-96, April 2004
- [8] A. Gurto, J. Korhonen, "Effect of Vertical Handovers on Performance of TCP-Friendly Rate Control", *ACM Mobile Computing and Communications Review*, 8(3):73-87, July 2004
- [9] C. Palazzi, B. Chin, P. Ray, G. Pau, M. Rocetti, "High Mobility in a Realistic Wireless Environment: a Mobile IP Handoff Model for NS-2", *Proc. of IEEE TRIDENTCOM 2007*, Orlando, FL, USA, May 2007
- [10] C. Perkins et al, "IP Mobility Support for IPv4", IETF RFC-3344, The Internet Society, 2002
- [11] P. Eronen et al, "IKEv2 Mobility and Multihoming Protocol (MOBIKE)", IETF RFC-4555, The Internet Society, 2006
- [12] S. Frankel, *Demystifying the IPsec Puzzle*, Norwood, MA, Artech House, 2001