Wireless Communications Security

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Wireless security team

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Outline

- Introduction
  - Wireless technologies and security requirements
- Wireless confidentiality
- Wireless availability
- Some challenges

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Generations of cellular phones

- 1G
  - AMPS: 1980s, FM, FDMA, handover between cells, limited roaming between networks
- 2G
  - GSM: 1990s, digital-coding of voice, TDMA, Subscriber Identity Module (SIM), data communications
- 3G
  - 3GPP/UMTS: 1998-, WCDMA, global roaming, 2 Mbps data
- 4G
  - All-IP-based, 100 Mbps data

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1G and 2G Networks in Canada

	AMPS	CDMA	GSM/GPRS	iDEN	TDMA
Bell Mobility	X	X			
Rogers Wireless	X		X		X
Telus Mobility	X	X			
Island Telecom		X			
MT&T Mobility		X			
Microcell			X		
Mike Clearnet				X	
Source: www.cellular-news.com					

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3G Wireless in Canada

Name	Price Paid	Est. start date
Bell Mobility	US$452.7 million	TBA
Rogers Wireless	US$247.3 million	TBA
Telus	US$223.7 million	Under trial
W2N	US$7.16 million	TBA
Thunder Bay Telephone	US$377,000	TBA
Cost per head of adult population US$36.45		
Source: www.cellular-news.com		

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Security requirements

- Confidentiality
- Availability
- Integrity
- Misbehavior absence
- Participant legitimacy

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Why is wireless security difficult?

- Interception easiness
- Medium access uncontrollability
- Topology dynamism
- Evolutional context

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Wireless confidentiality

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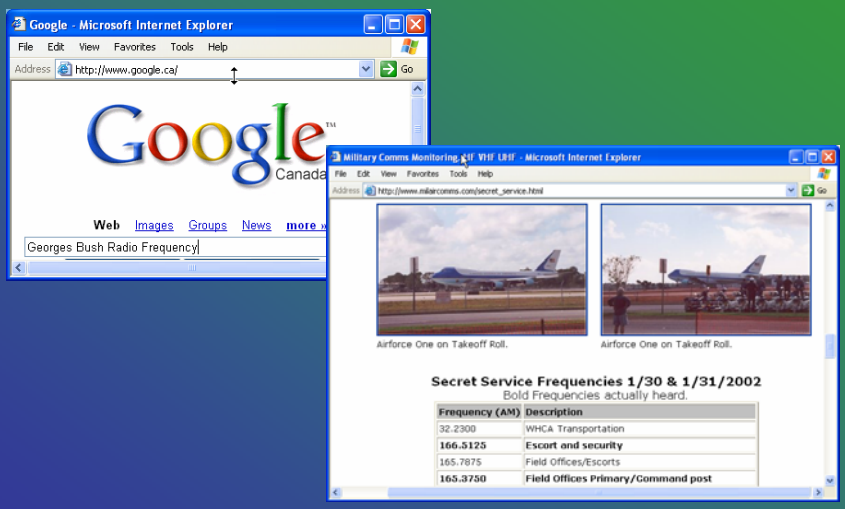
Finding frequencies



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Eavesdropping countermeasures

- Regulations
- Advanced modes
- Encryption

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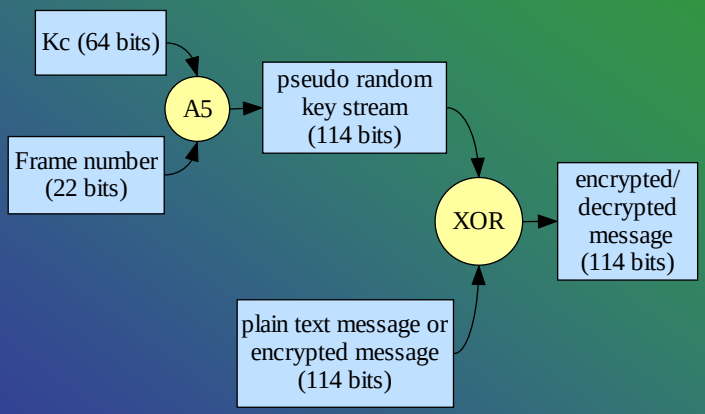
Encryption/Decryption in GSM



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Stream Cipher Weakness

$$Encrypted\ \ (M_1) \oplus Encrypted\ \ (M_2) = M_1 \oplus M_2$$

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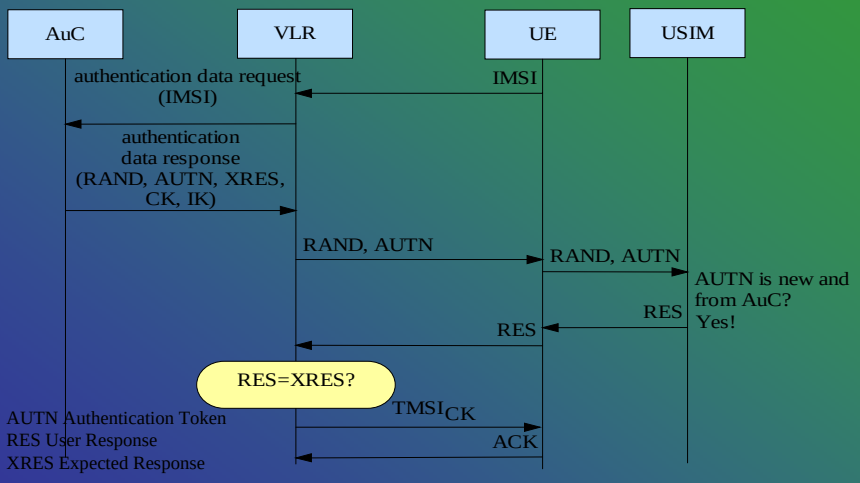
Mutual Authentication and Key Agreement in UMTS



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Wireless availability

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Why is availability difficult?

- Jamming
- Pile-up

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Jamming

Shannon's model:

$$C = W \log\left(1 + \frac{S}{N}\right)$$

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How to Deal With Jamming?

- Increase the power
  - GPS III, planned for 2010
- Use gain antenna
- Increase the bandwidth
  - Spread spectrum
  - Ultra Wide Band
    - Bandwidth greater than 25% center frequency

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Pile-up

Images by: J.&G. Naudet (9/11/2001)

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Some challenges

- Multimode/hybrid technology devices
- Introduction of new defense methods in existing systems
- Detection/adaptation/resistance to extreme conditions

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