Wireless Systems Security

EE/NiS/TM-584-A/WS

Bruce McNair
bmcnair@stevens.edu

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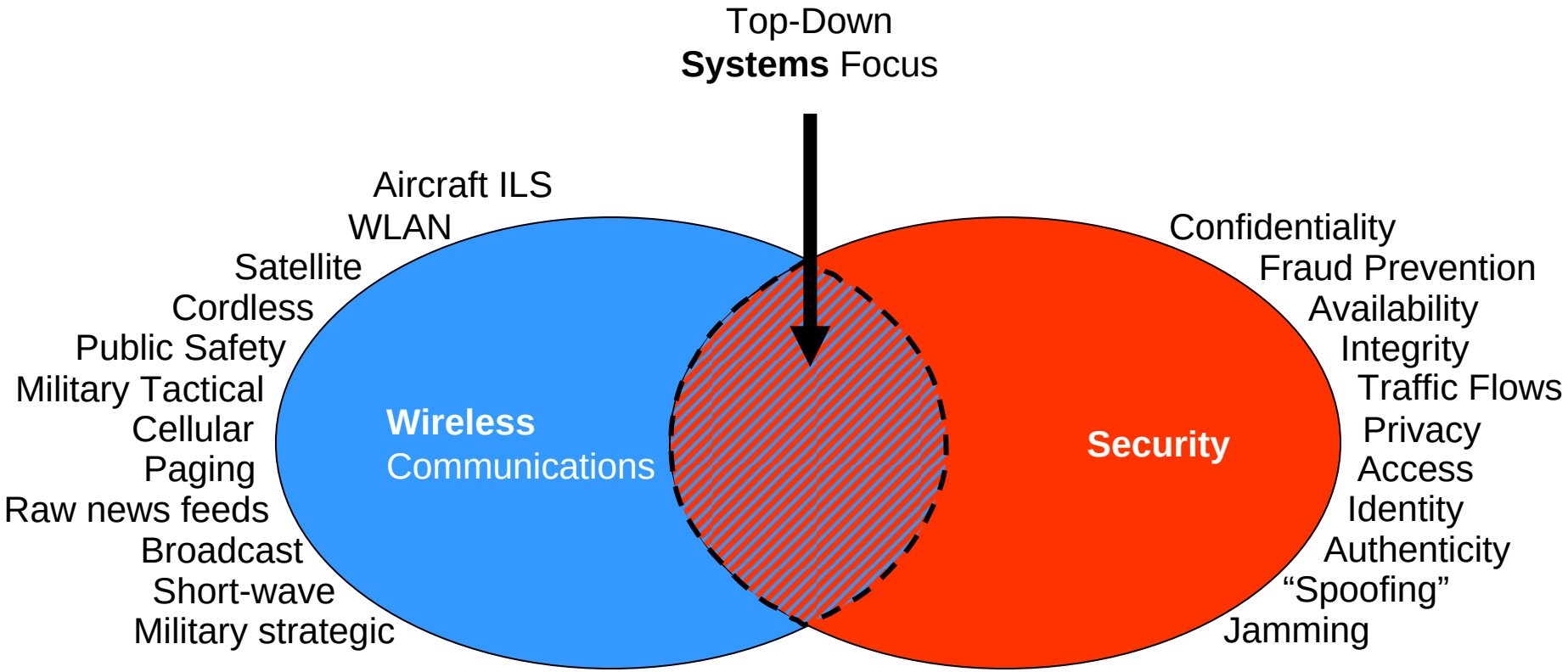
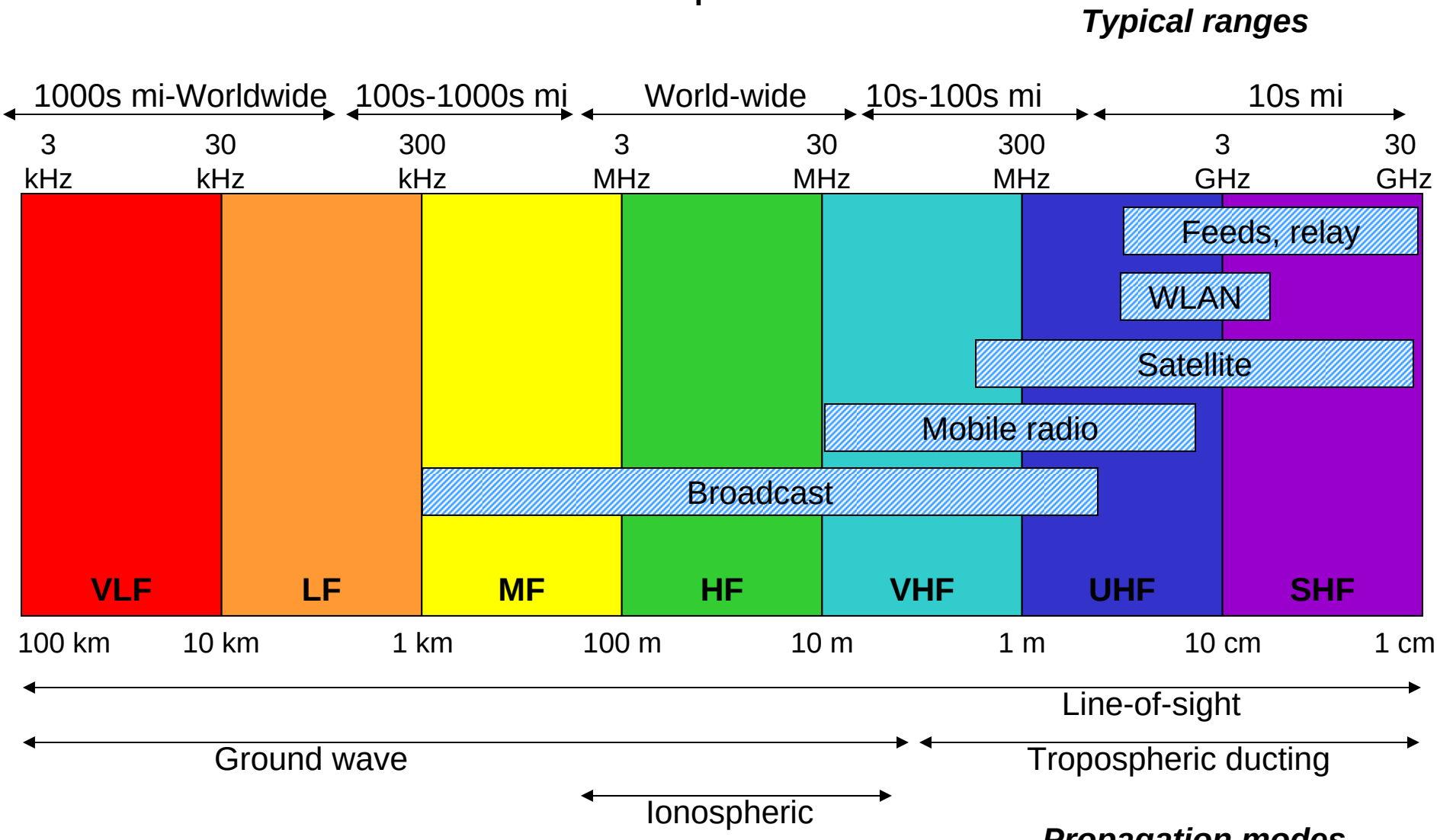
Class 12 – Wrap-up and Future Directions

The Intersection of Wireless and Security

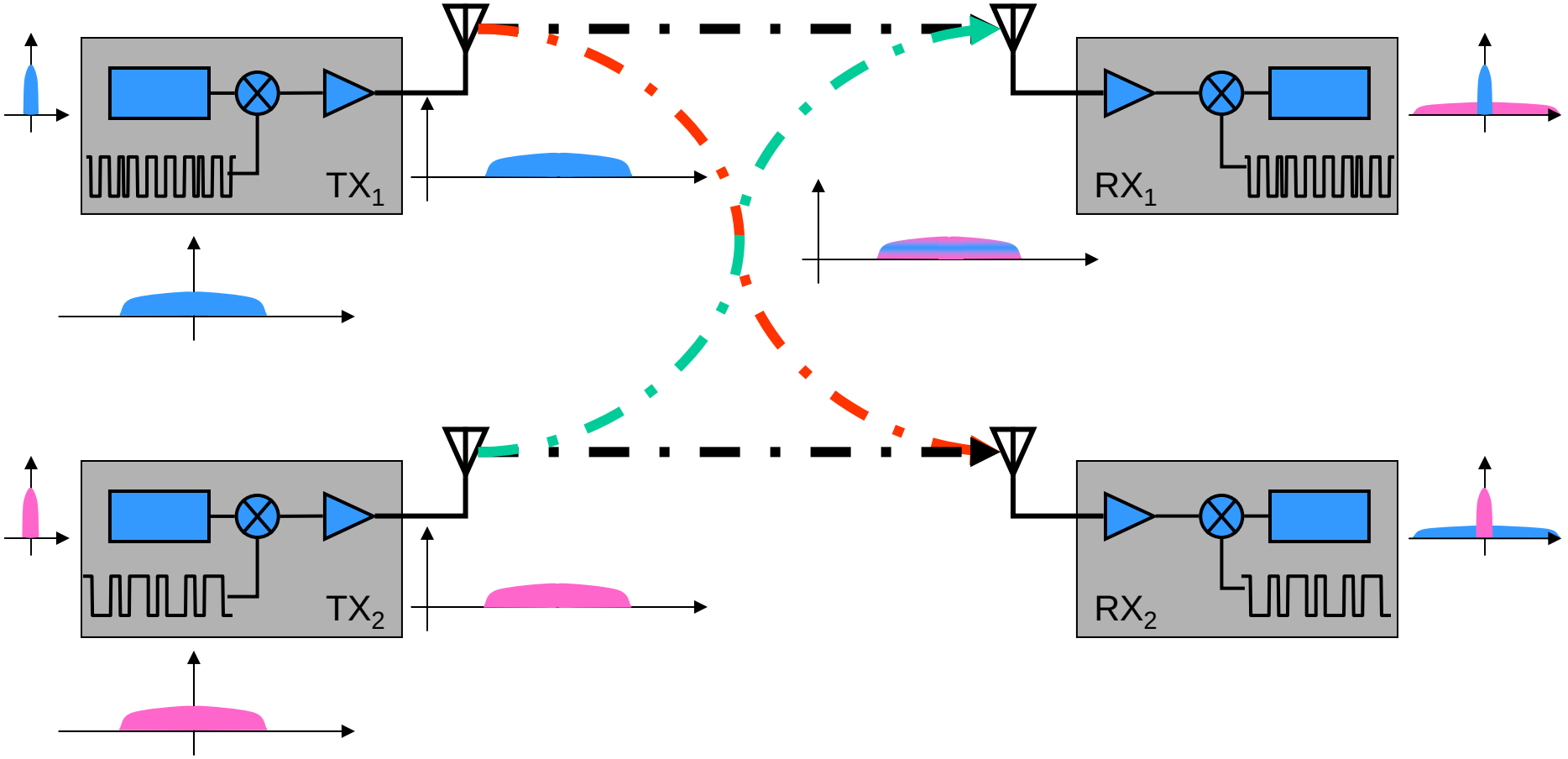


RF Spectrum



See http://www.ntia.doc.gov/osmhome/allochrt.pdf for full details (1996)
Or http://www.jsc.mil/images/speccht.jpg for the military view

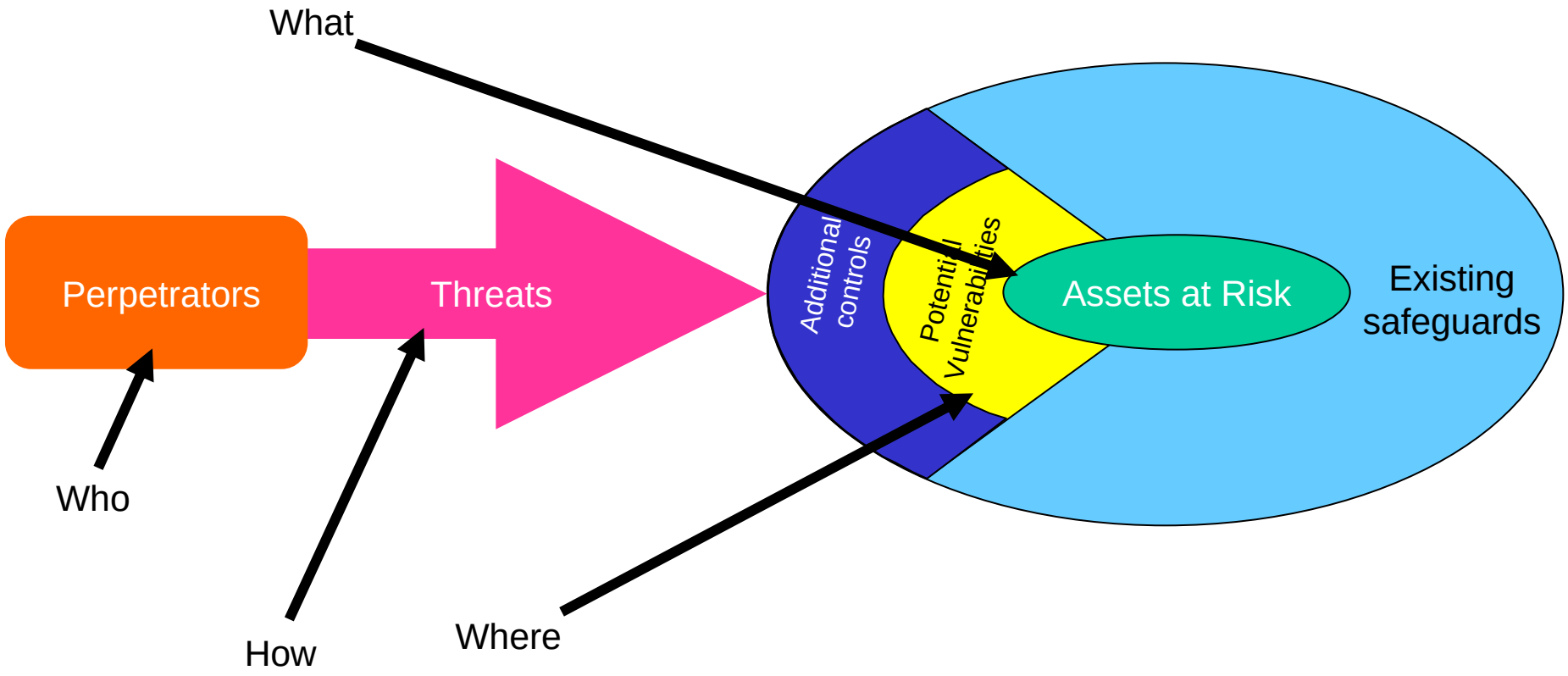
CDMA Spreading and Despreading



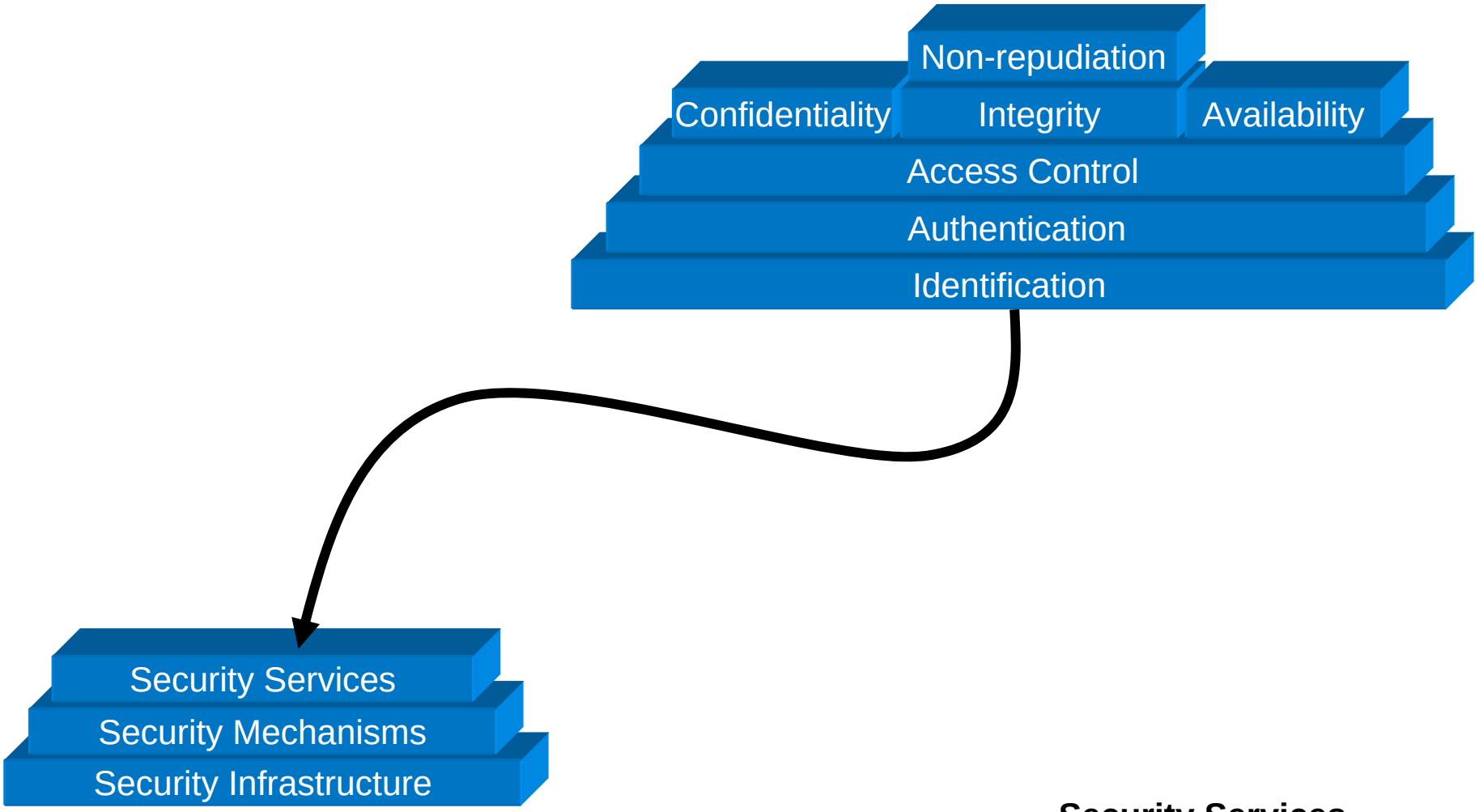
Spreading factor ~ (RF Bandwidth)/(Baseband bandwidth)

How Much Security Is Enough?

A security assessment model

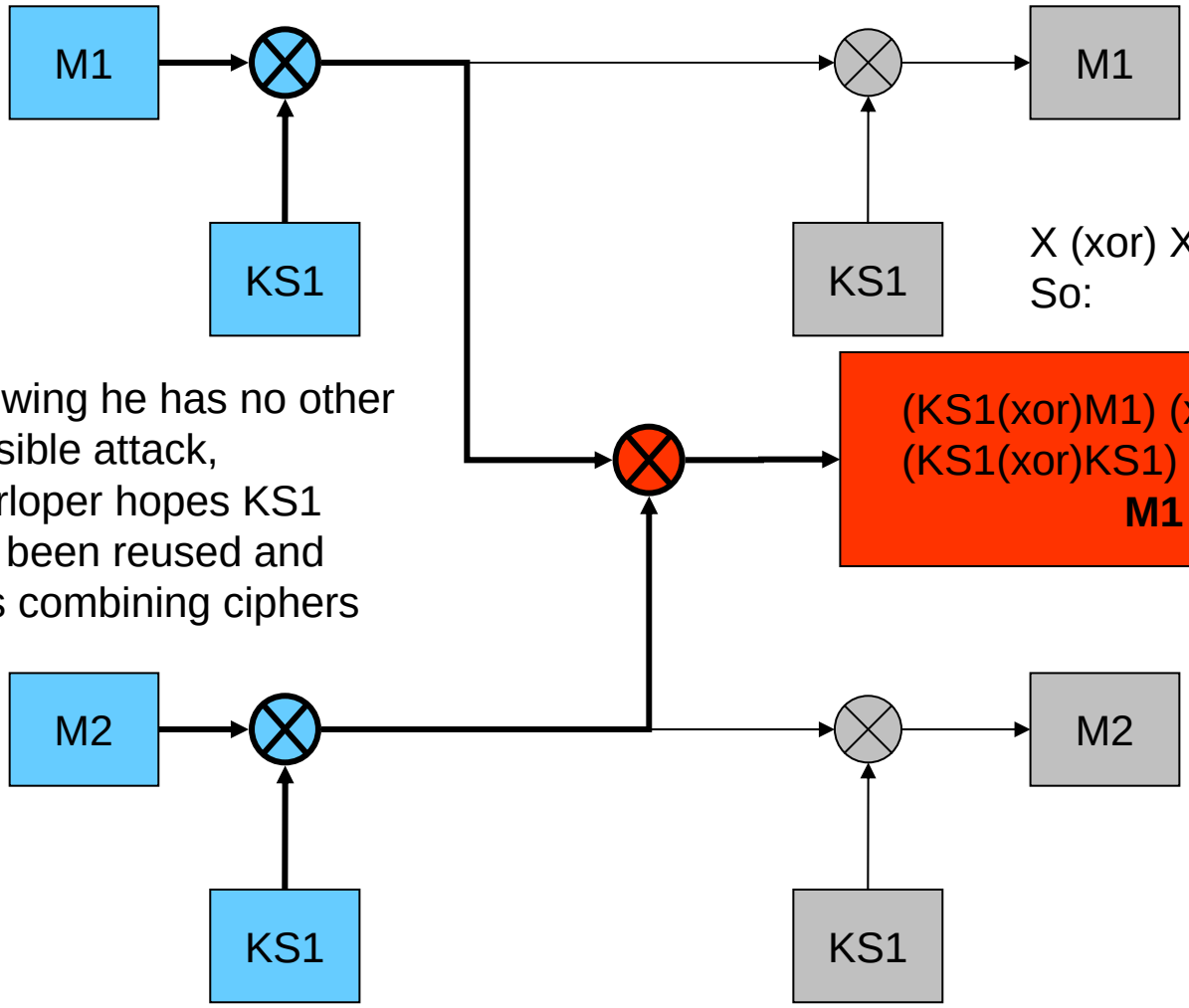


One Structured Way of Viewing Security



Security Services

One-bit-pad Key Reuse



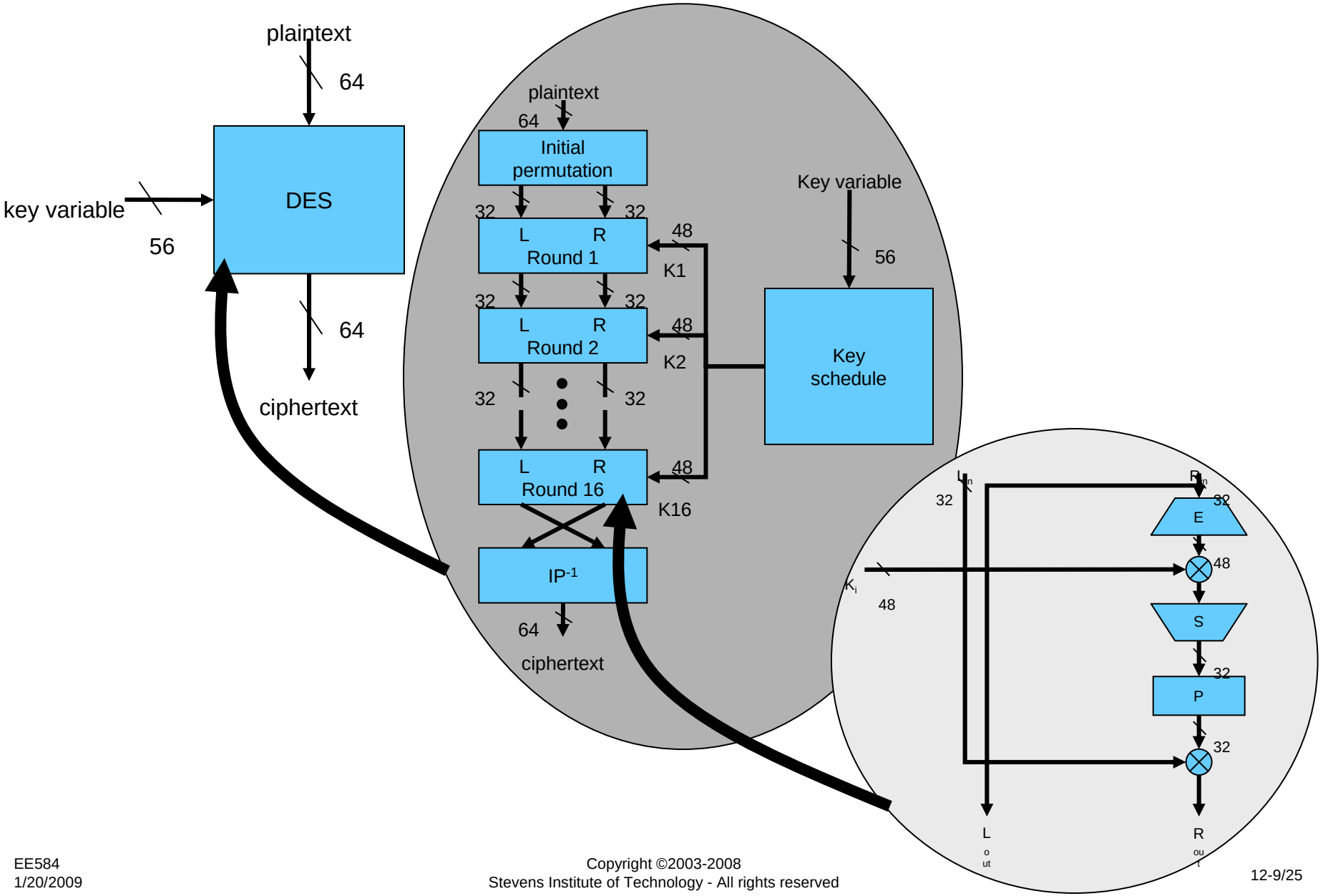
X (xor) X = 0, and Y (xor) 0 = Y,
So:

(KS1(xor)M1) (xor) (KS1 (xor) M2) =
(KS1(xor)KS1) (xor) (M1 (xor) M2) =
M1 (xor) M2

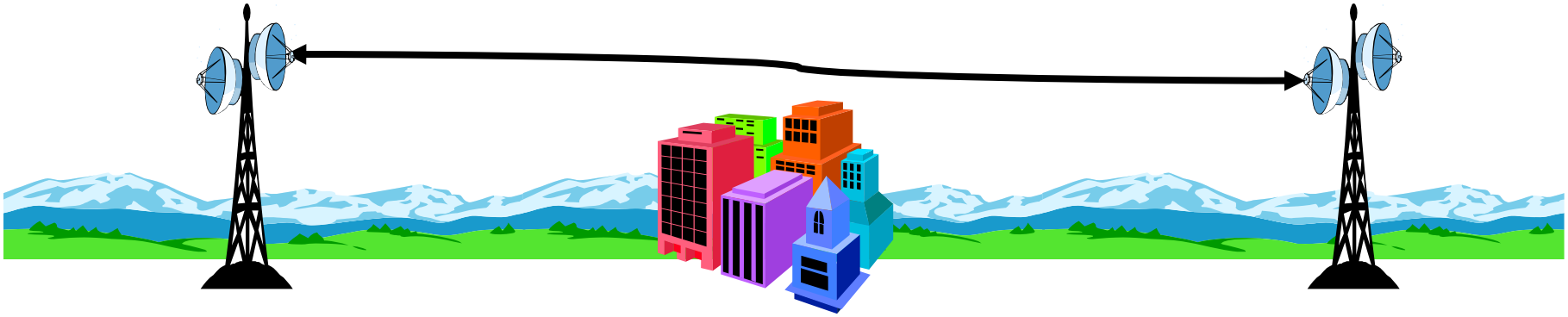
Knowing he has no other possible attack, interloper hopes KS1 has been reused and tries combining ciphers

This is the polyalphabetic encryption of M1 using M2 as a key stream!!

DES as an Example of Encryption Algorithm

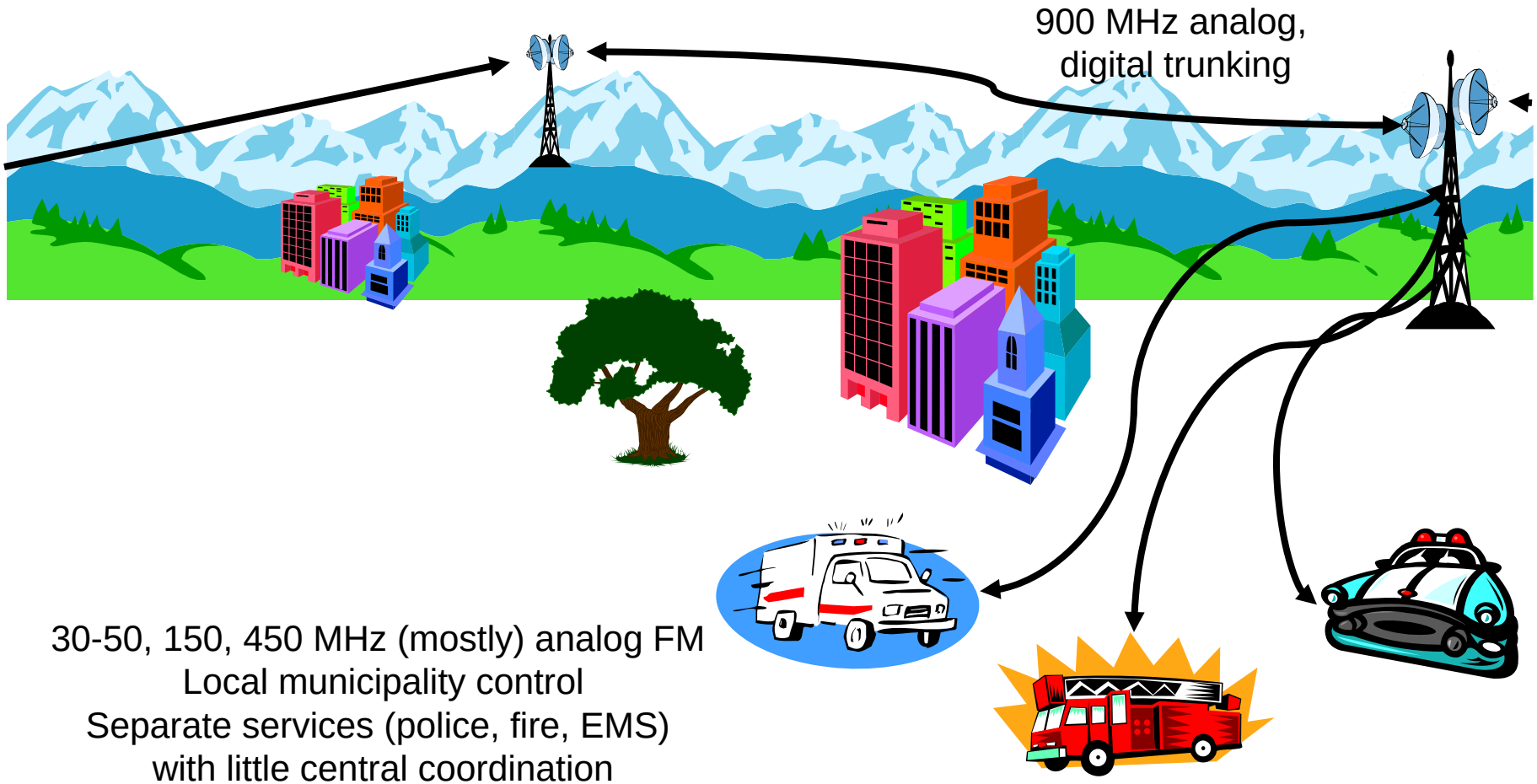


Case 1
Terrestrial Microwave RF Telephone Relay System



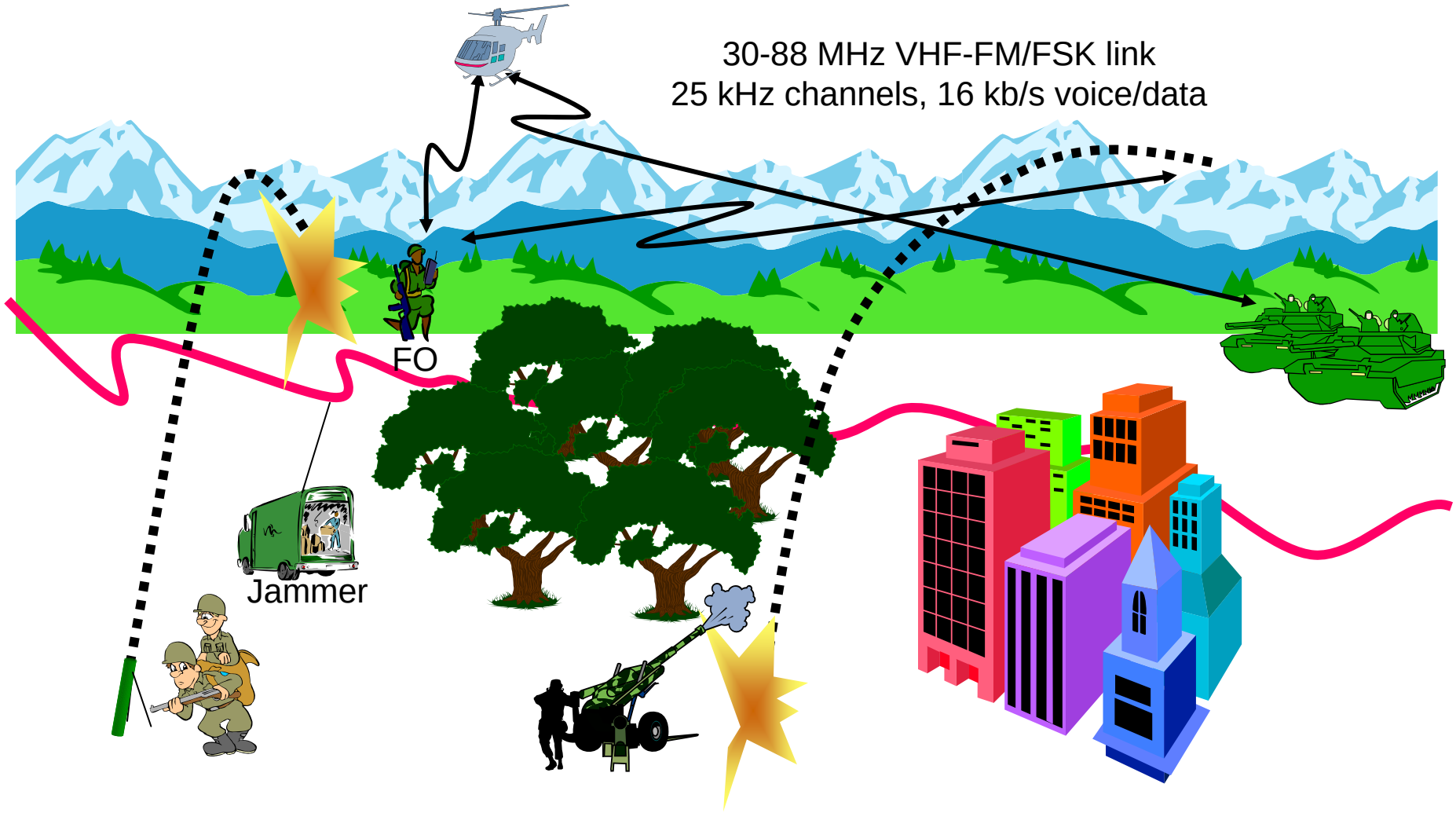
4 GHz
Analog SSB FDMA
Multichannel Voice traffic
CCS signaling
Washington, DC area

Case 2 – Public Safety Wireless Networks

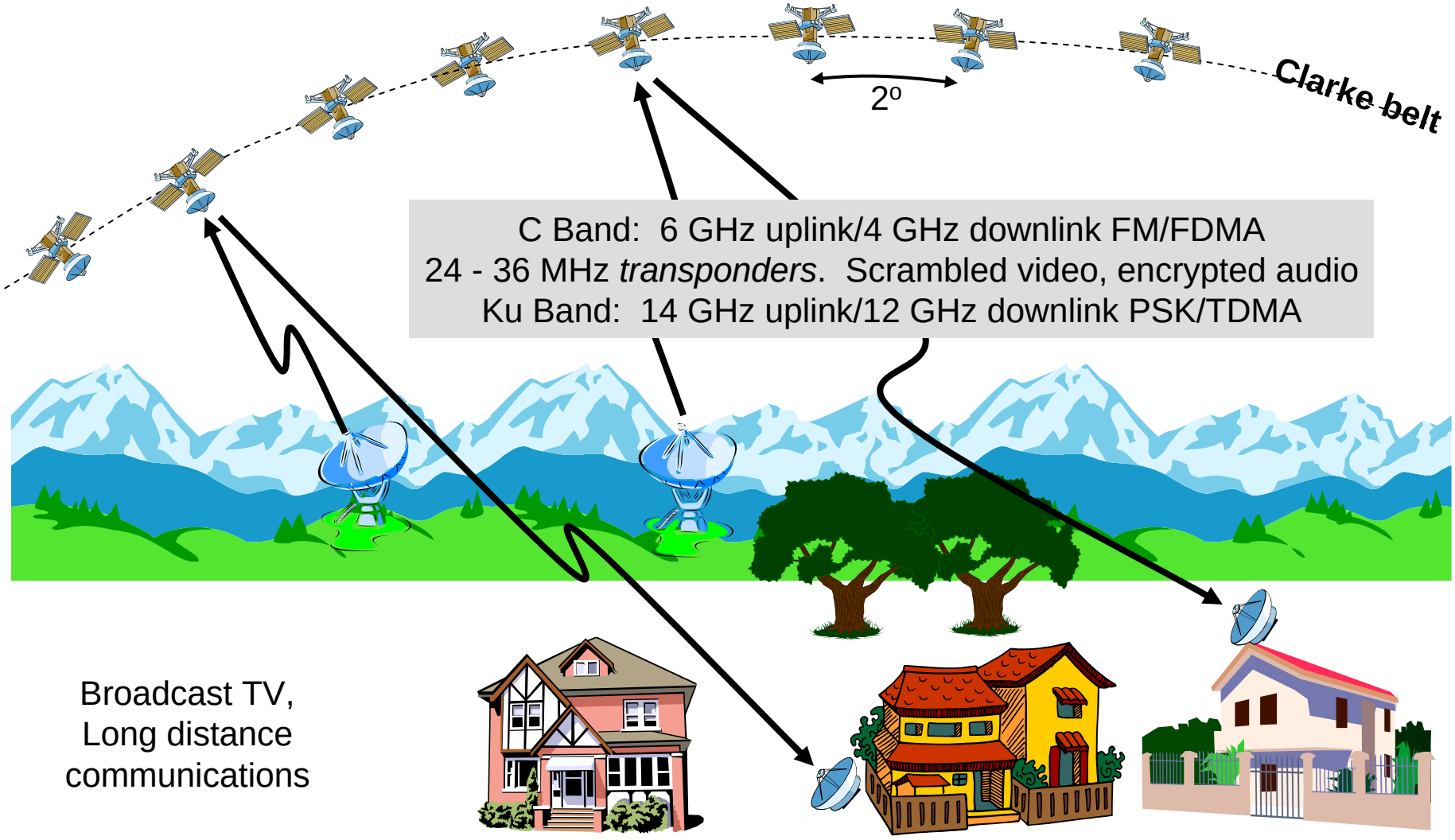


30-50, 150, 450 MHz (mostly) analog FM
Local municipality control
Separate services (police, fire, EMS)
with little central coordination
Some point-to-point; heavy use of RF repeaters

Case 3 – Military Tactical Radio Systems

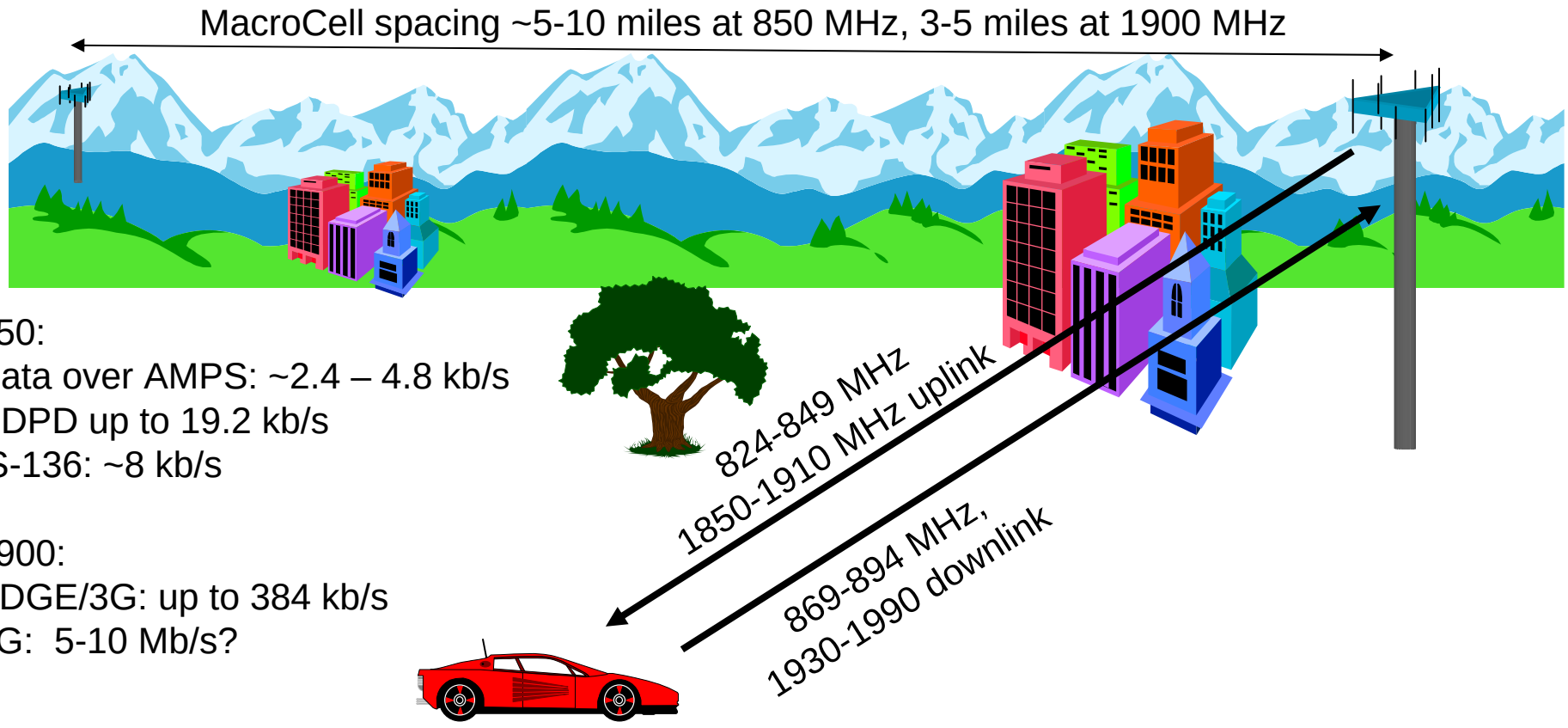


Case 4 – Satellite Communications Systems



Broadcast TV,
Long distance
communications

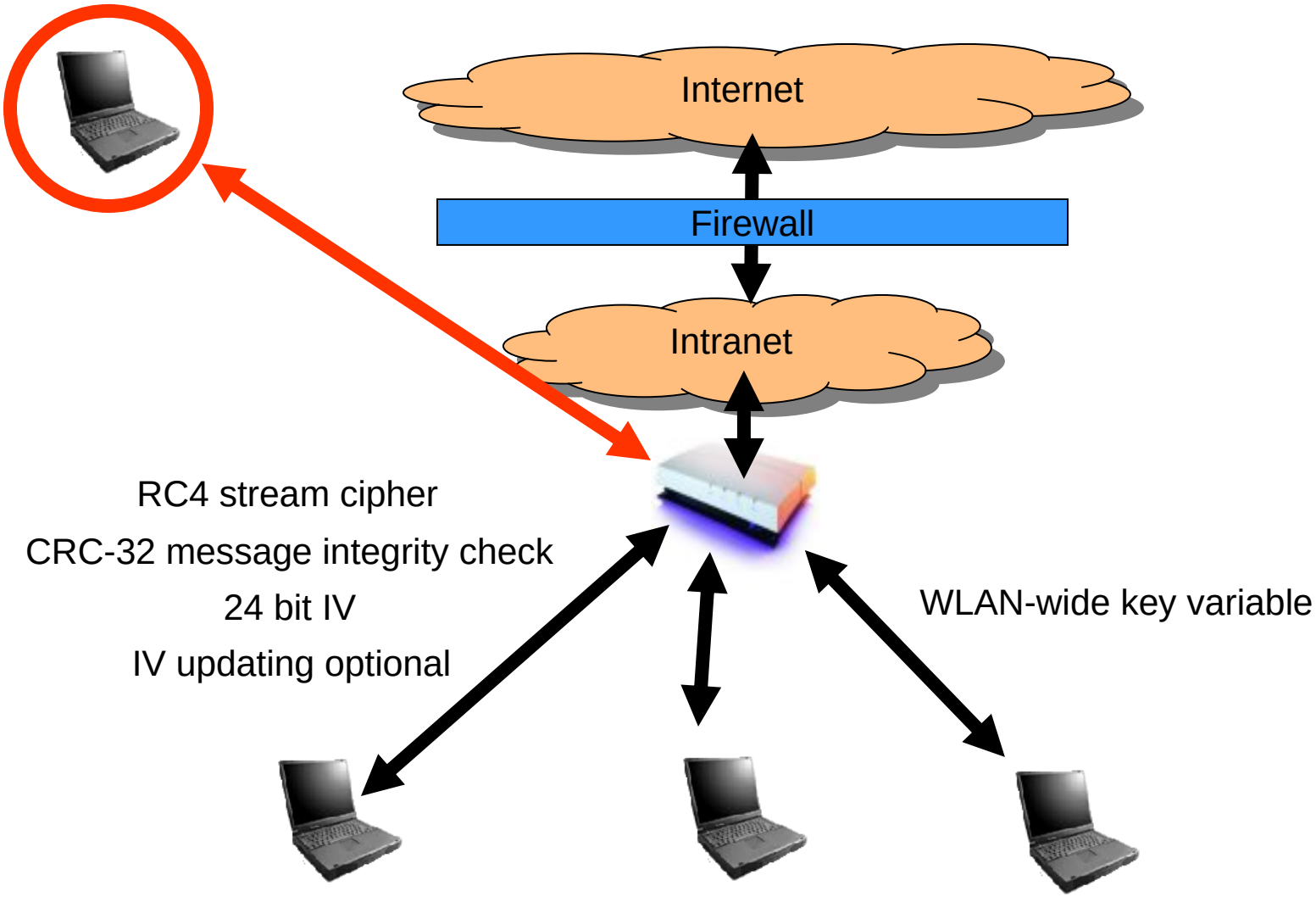
Case 5 – Wide Area Wireless Data Services
CDPD, 3G, EDGE, etc.



850:
Data over AMPS: ~2.4 – 4.8 kb/s
CDPD up to 19.2 kb/s
IS-136: ~8 kb/s

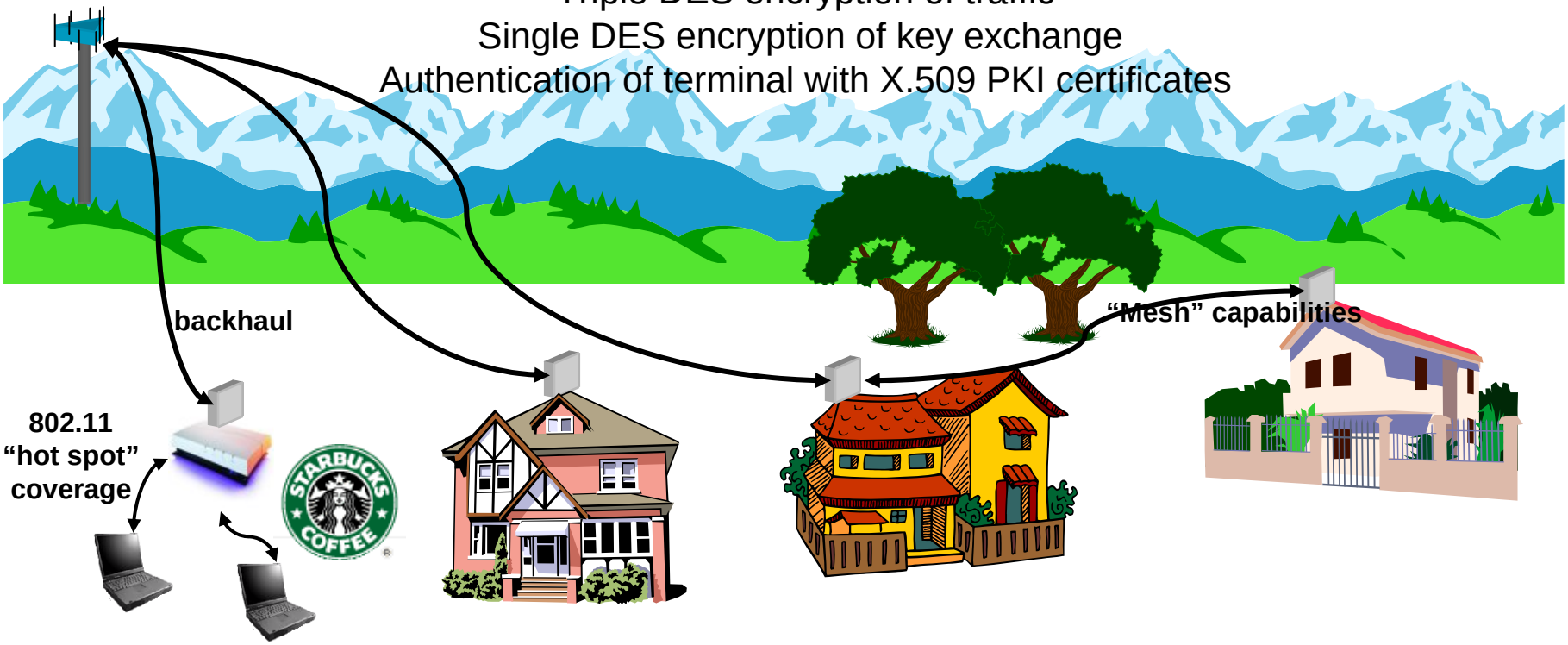
1900:
EDGE/3G: up to 384 kb/s
4G: 5-10 Mb/s?

Case 6 – Wireless LANs
802.11a, b, g



Case 7 –
Wireless Metropolitan Area Networks (W-MANs)
802.16

802.16a: 2-11 GHz 256/2048 carrier OFDM,
802.16.1: 10 – 66 GHz LOS
120 Mb/s capacity
T1+ user data, multiple voice channels, Wireless Local Loop
Triple DES encryption of traffic
Single DES encryption of key exchange
Authentication of terminal with X.509 PKI certificates



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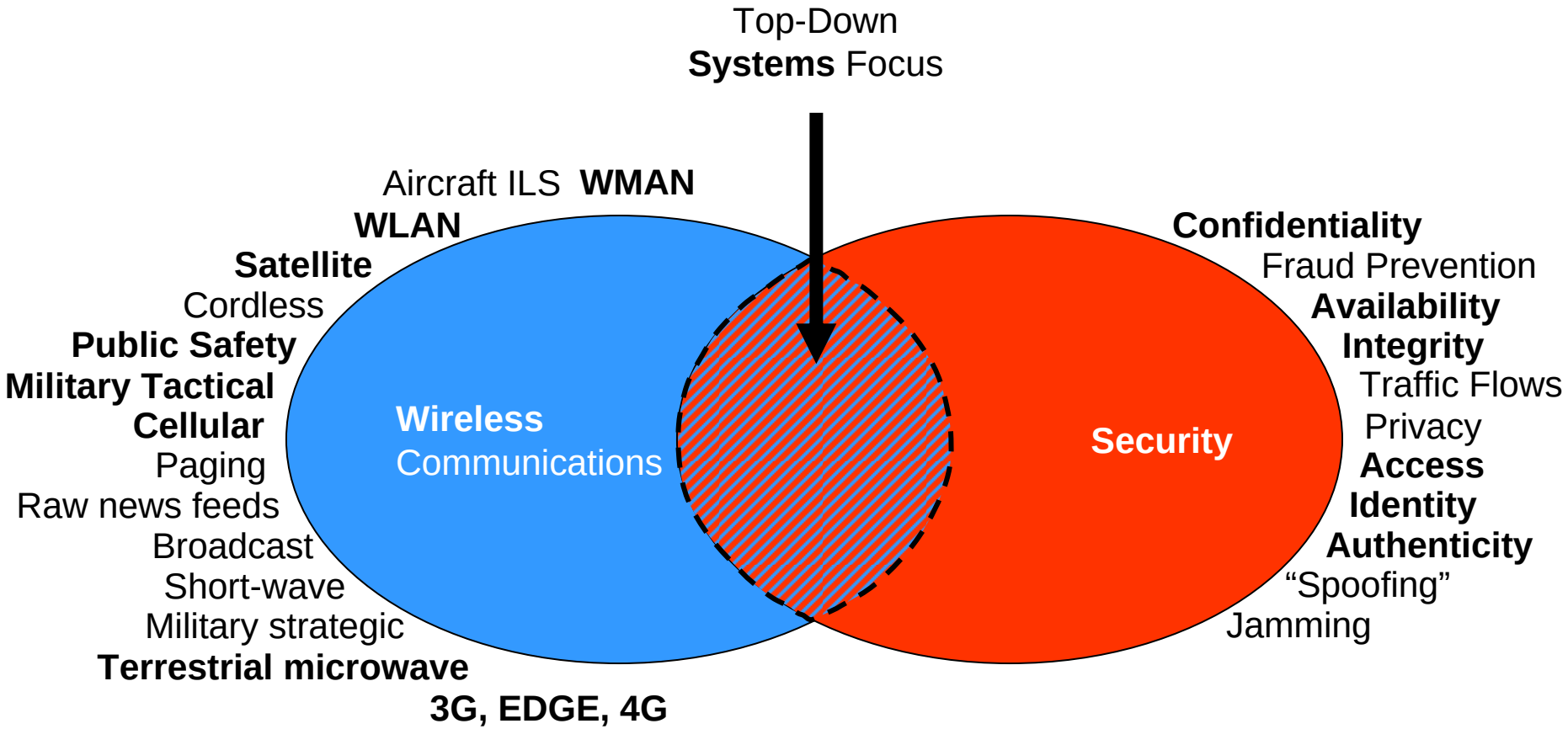

Key Points

- Security:
  - is best designed in, rather than added on
  - issues must be examined in the broadest context
  - cannot be taken for granted

- The interaction between complex systems is a fertile growth medium for security issues
- Obfuscation doesn't help
  - Where does mold tend to grow in homes?

- Wireless systems are generally:
  - New designs (not much field experience)
  - Complex (interactions between varied technologies)
  - Designed with short development cycles
  - Closed systems at introduction

- Broadcast nature of most wireless systems creates issues that wired systems don't share:
  - Ease of monitoring
  - Potential for jamming
  - Attack from anywhere – difficulty in controlling access to airwaves

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An effective security process would be one that
- continually ***anticipates*** threats,
- ***prioritizes*** the most credible threats, and
- ***adapts*** to meet those threats ***before*** they degrade the system