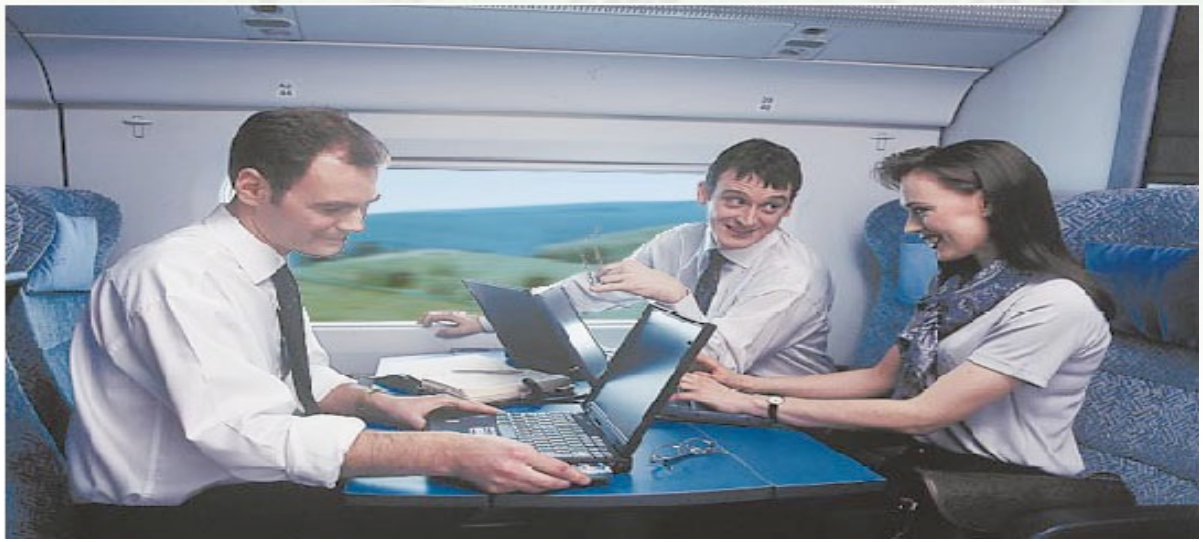
Overview of IEEE 802.11 Wireless LANs

- WLAN & IP Protocol Interoperability -

Juha Ala-Laurila
Nokia Mobile Phones
juha.ala-laurila@nokia.com



NOKIA

Presentation Outline

- WLAN Technology Update
  - Standards/Competition
- IEEE 802.11 WLAN Standard
  - What is defined by standard
  - IEEE 802.11 functions in TCP/IP model
- Connecting WLANs as part of IP infrastructure
  - Interworking problems
  - Integration (security, mobility, QoS, …)
  - Need for advanced IP roaming protocols
- Conclusions

NOKIA

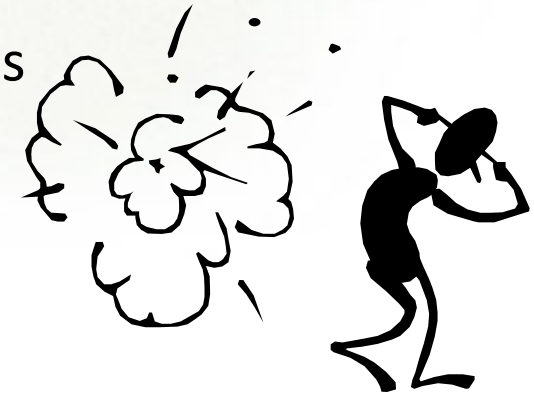
Wireless IP Networking Revolution

Past	Present Demand	Future
Fixed Data 	**Mobility** with **Network Connectivity** (Data + Voice)	**WLAN Unlicensed Bands** — Local Area - On campus - At home • Personal mobility • High data rate • Incremental infrastructure • Start 1998
Mobile Voice 		**"3G" WCDMA Licensed Bands** — Wide Area - On the road • Full mobility • Modest data rate • All new infrastructure • Start 2001

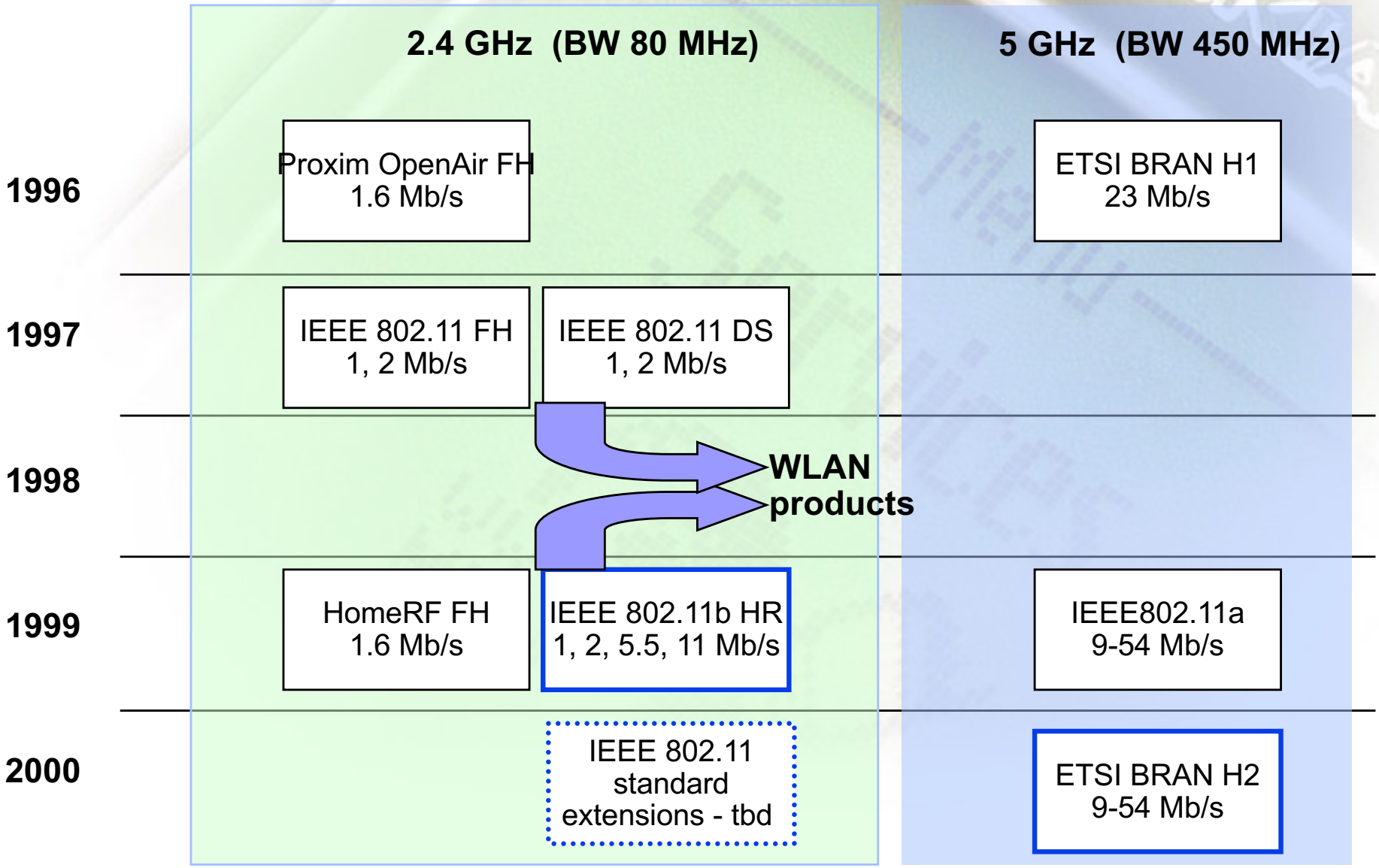
NOKIA

WLAN Dream Finally Seems to Happen...

- Recently lots of serious WLAN activities have been announced
  - Big players have invested in WLAN (Cisco, Intel, Nokia)
  - Integrated WLAN solutions appearing (Apple)
  - Even IETF is planning "meeting WLAN rules"
- Wireless IP solutions have lots of momentum!
  - People desire wireless IP terminals and access devices
- WLAN offers a good mobile solution for indoor IP access
  - Added value for the user - Flexibility, user mobility
  - Added value for ISP - solution for public high IP access
- WLAN standards are converging - IEEE 802.11b rules
  - Interoperability has been the main obstacle

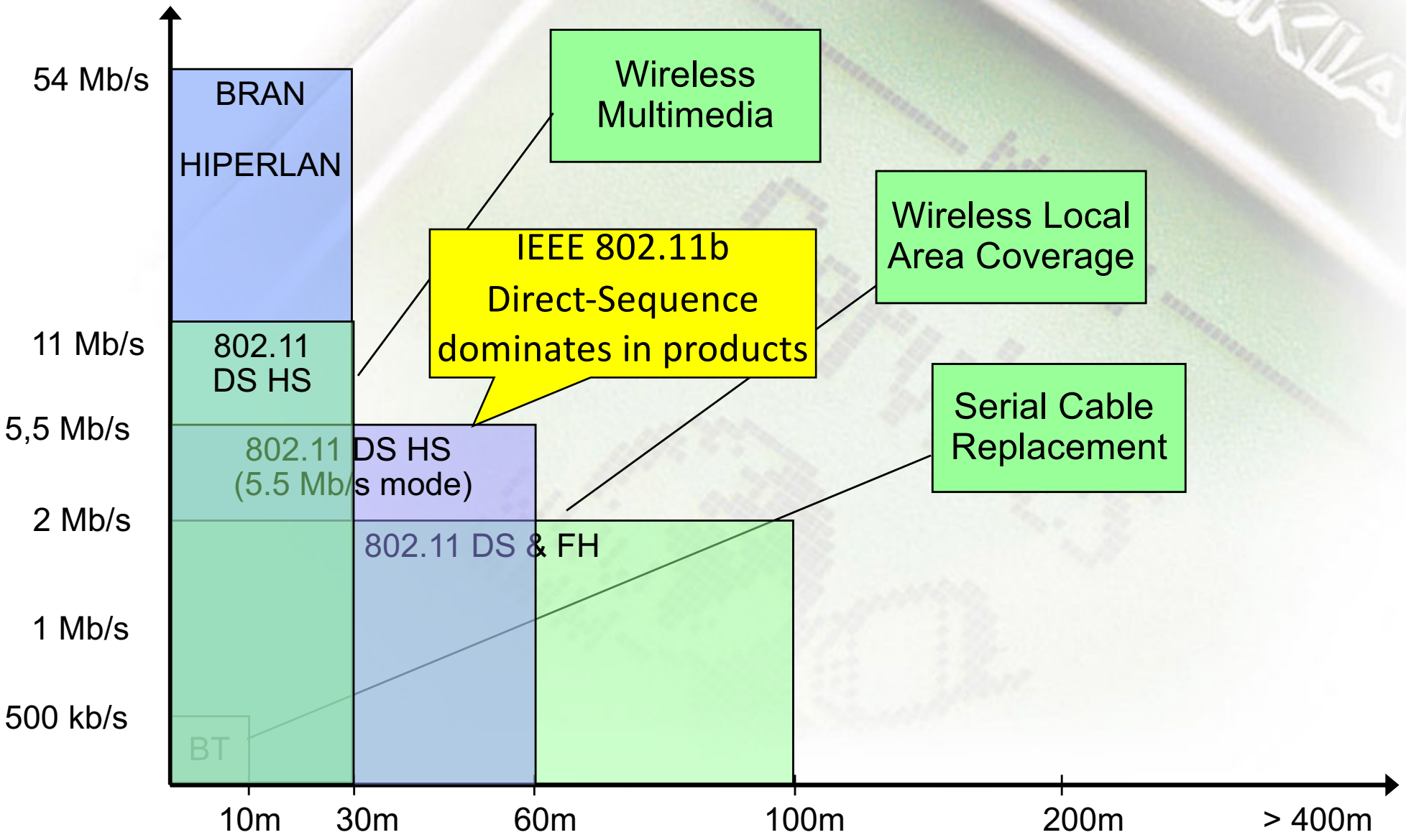


WLAN Standards Evolution



NOKIA

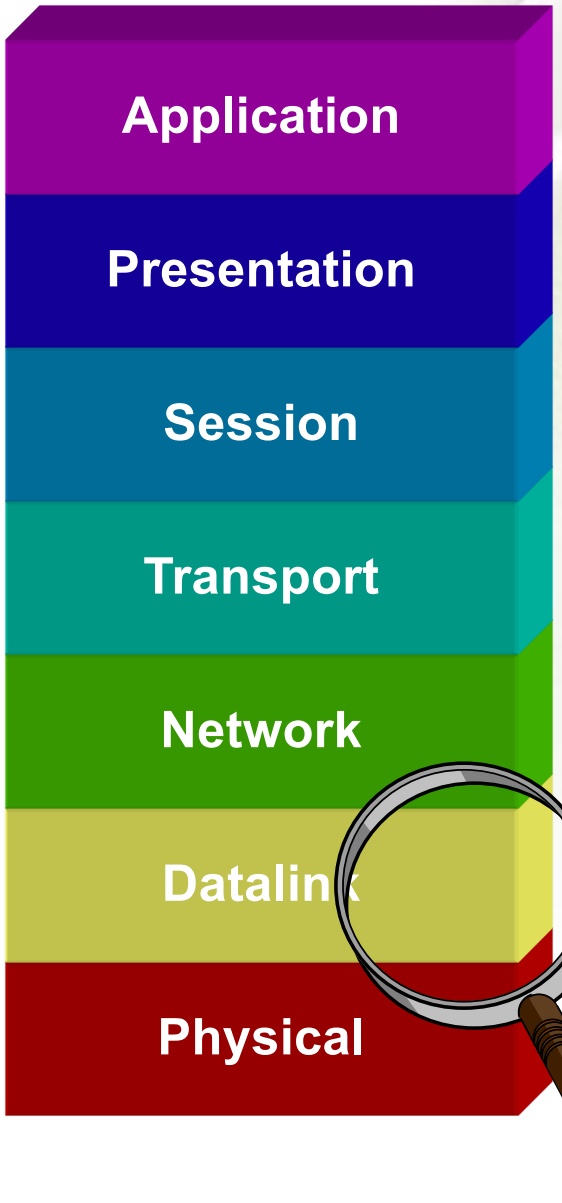
WLANs: Exploitation Scenarios



NOKIA

What Does WLAN Standards Define?

ISO Model Applied to the LAN world



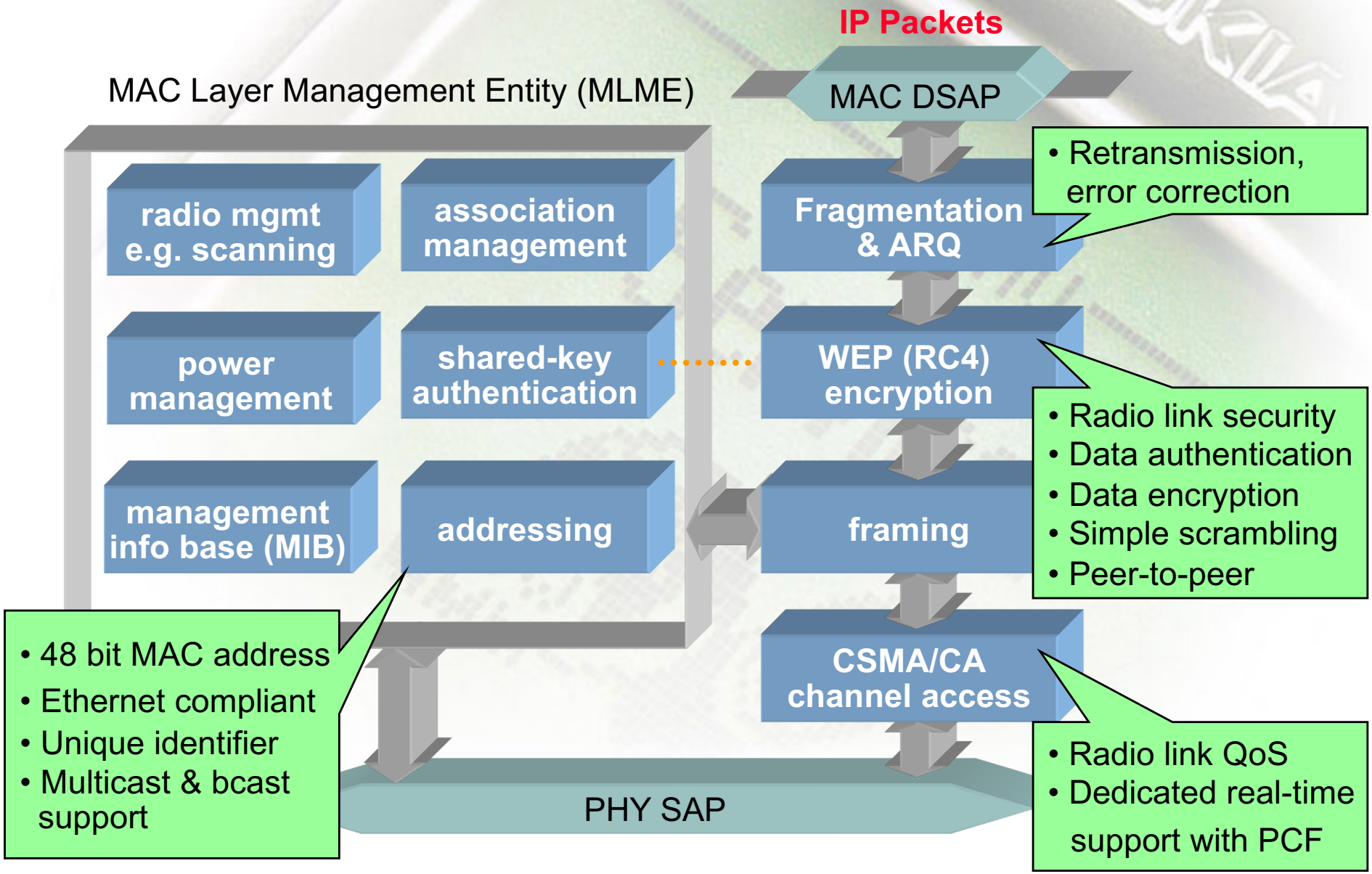
LLC provides traditional HDLC type protocol

MAC controls access to the physical channel according to a predetermined set of rules

Main differences:
- Radio link unreliable
- Higher error rate
- Eavesdropping risk
- All traffic goes via access point

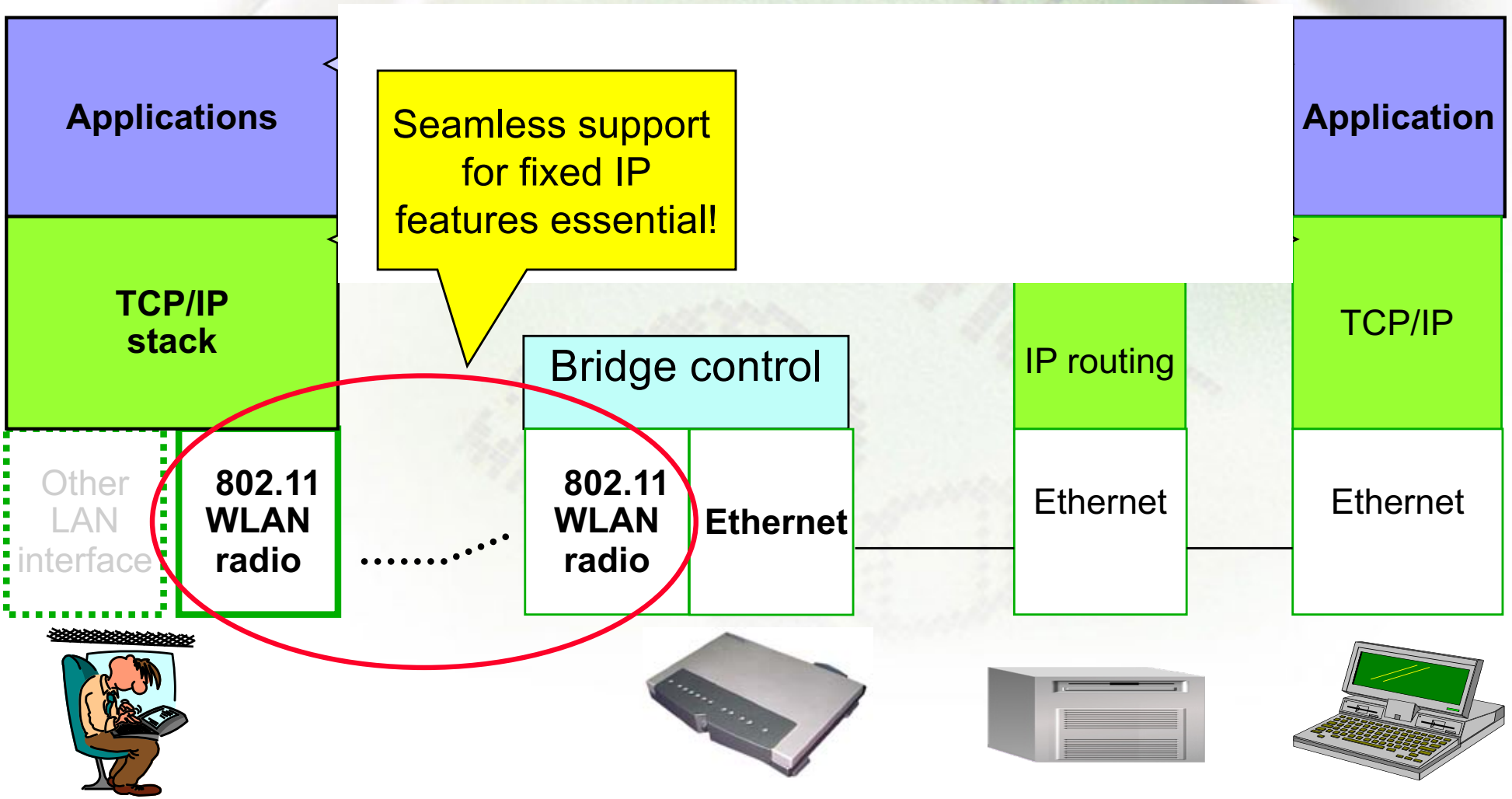
NOKIA

IEEE802.11 MAC Overview



NOKIA

WLAN - Plain Wireless Ethernet Extension



NOKIA

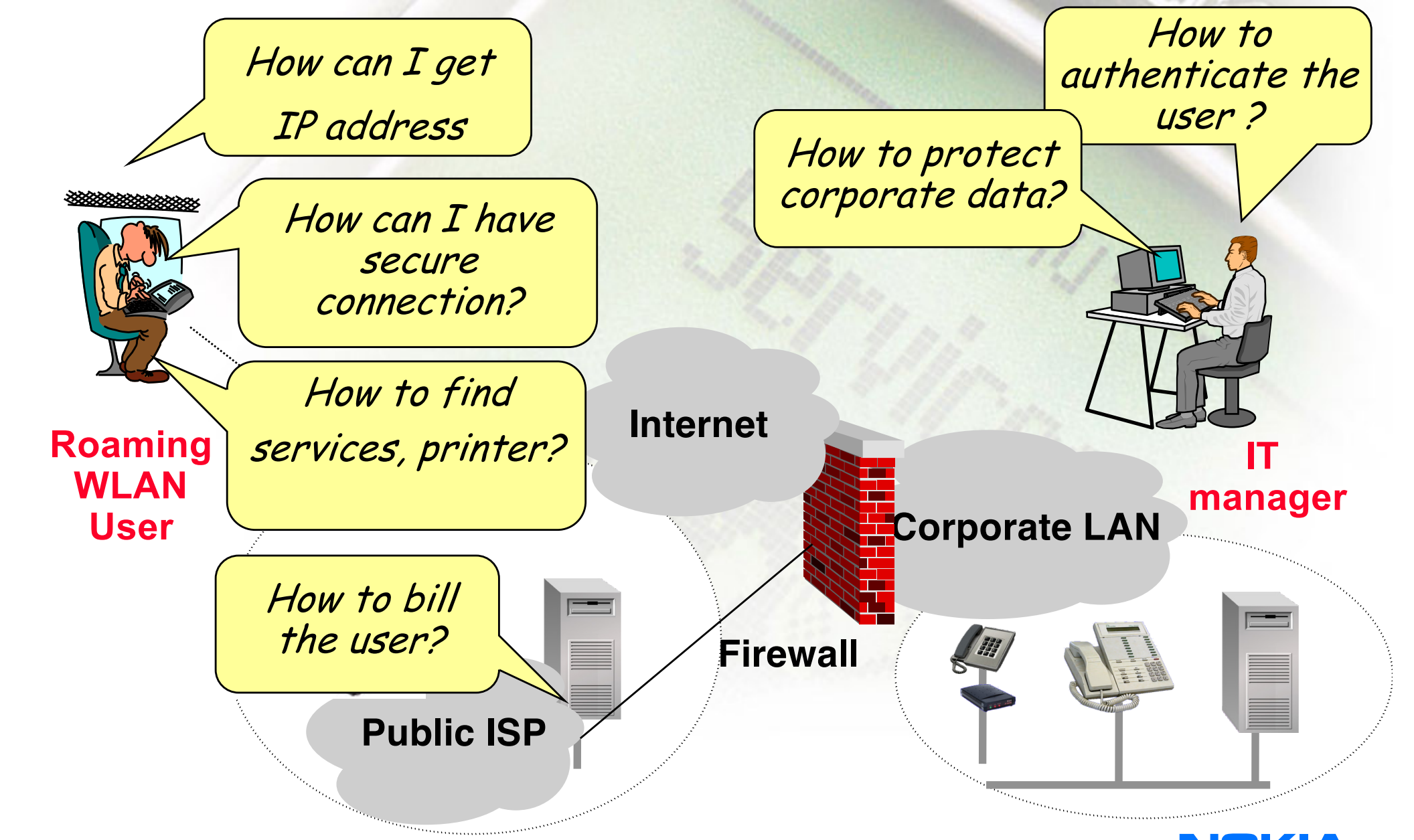
The Design Challenges are…

… The roaming IP devices with changing IP address, service location and service provider

…IP backbone and access networks have not been designed for moving terminals

… Radio link is vulnerable for security attacks and QoS deterioration

Typical Obstacles for IP Roaming...



NOKIA

Problems to Be Solved

- Terminal Mobility in the IP network
  - WLAN solves LAN level mobility but...
  - How to support mobility between IP sub-networks

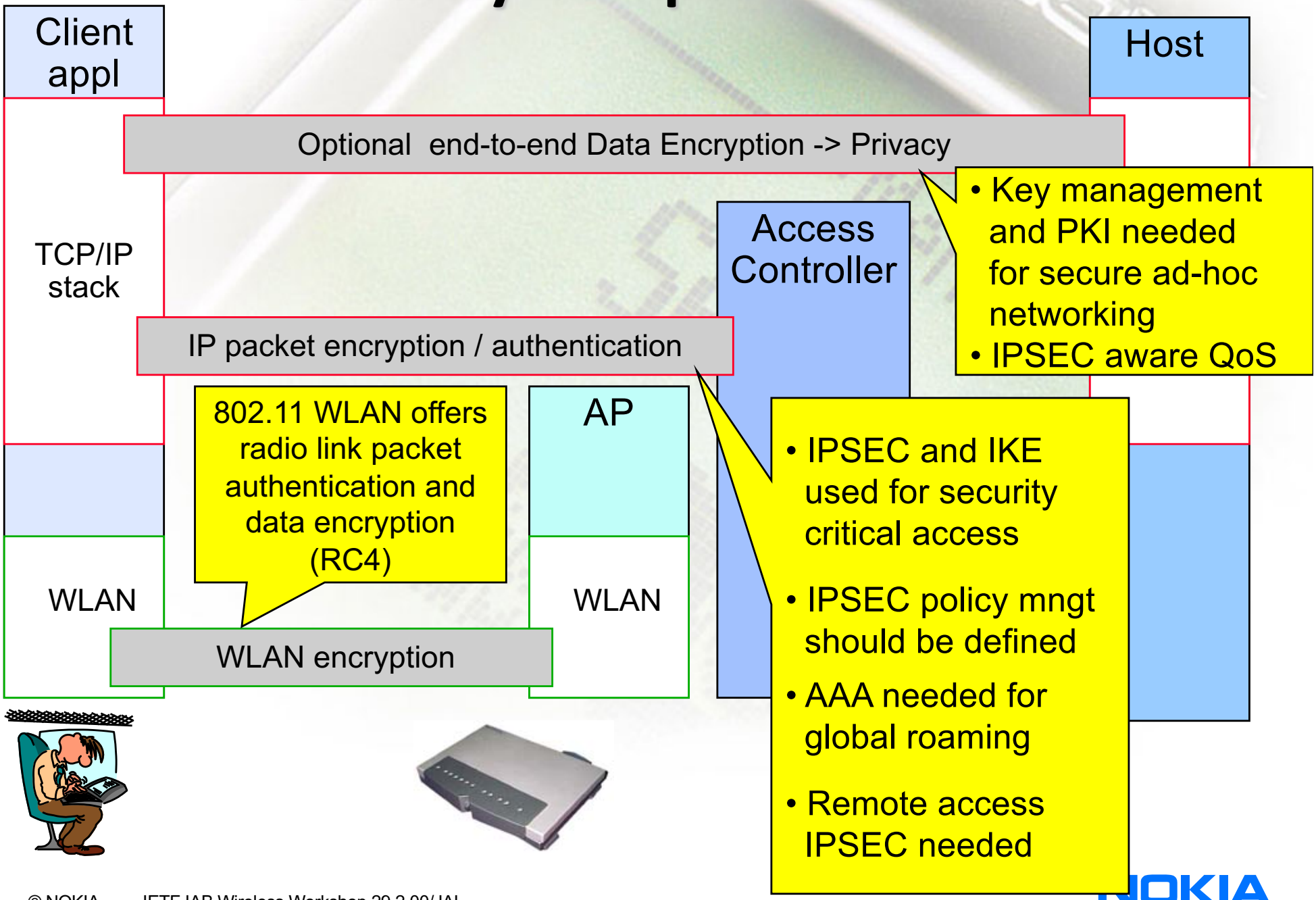
- Security Issues
  - User authentication and billing
  - End-to-end data security and remote access

- Configuration and Service discovery
  - How to know essential network parameters
  - How to locate services in a new network

- Wireless Quality of Service
  - How to map IP QoS classes into radio link
  - TCP behavior is not optimal in wireless world

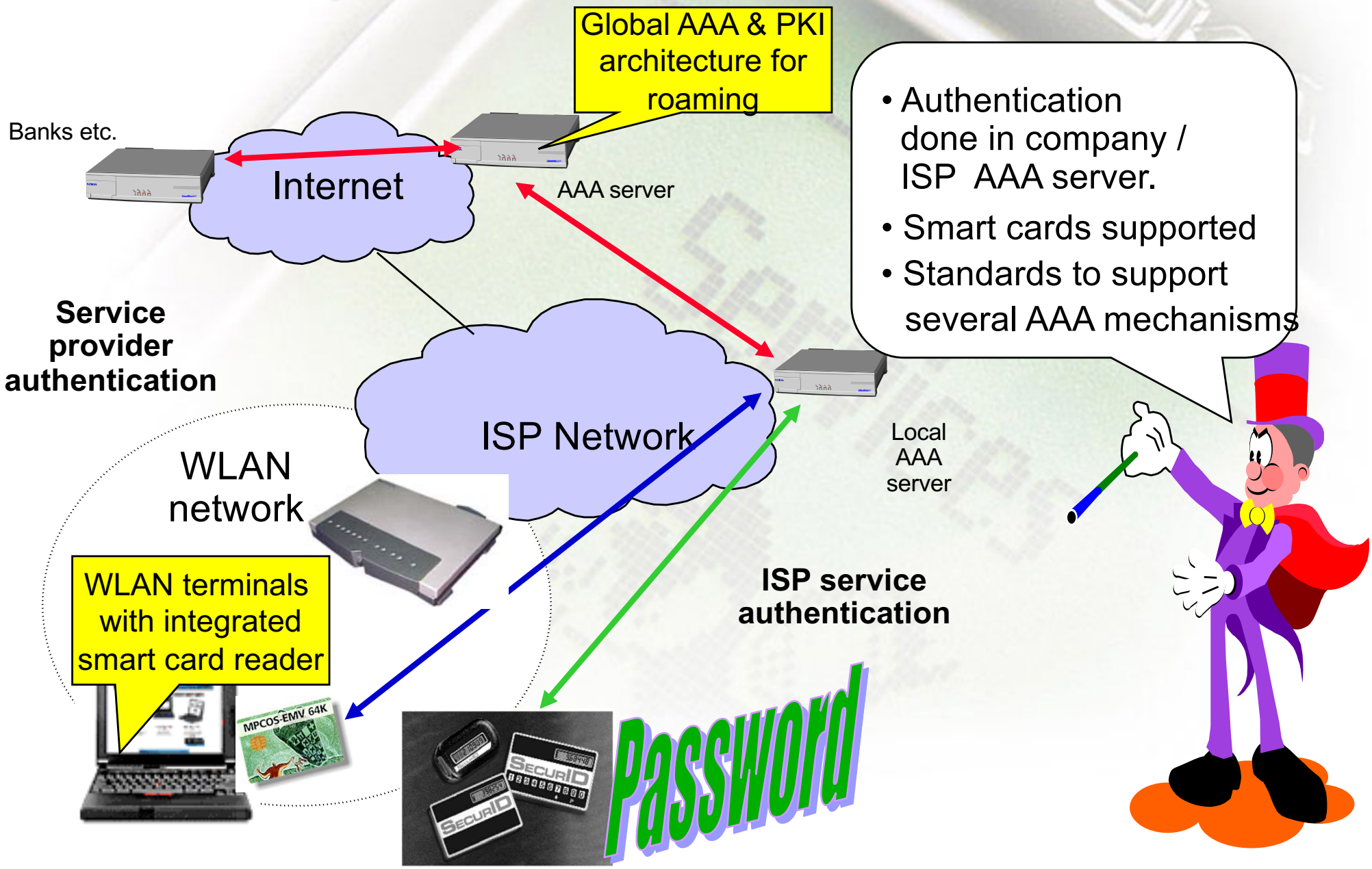
NOKIA

Security Components...



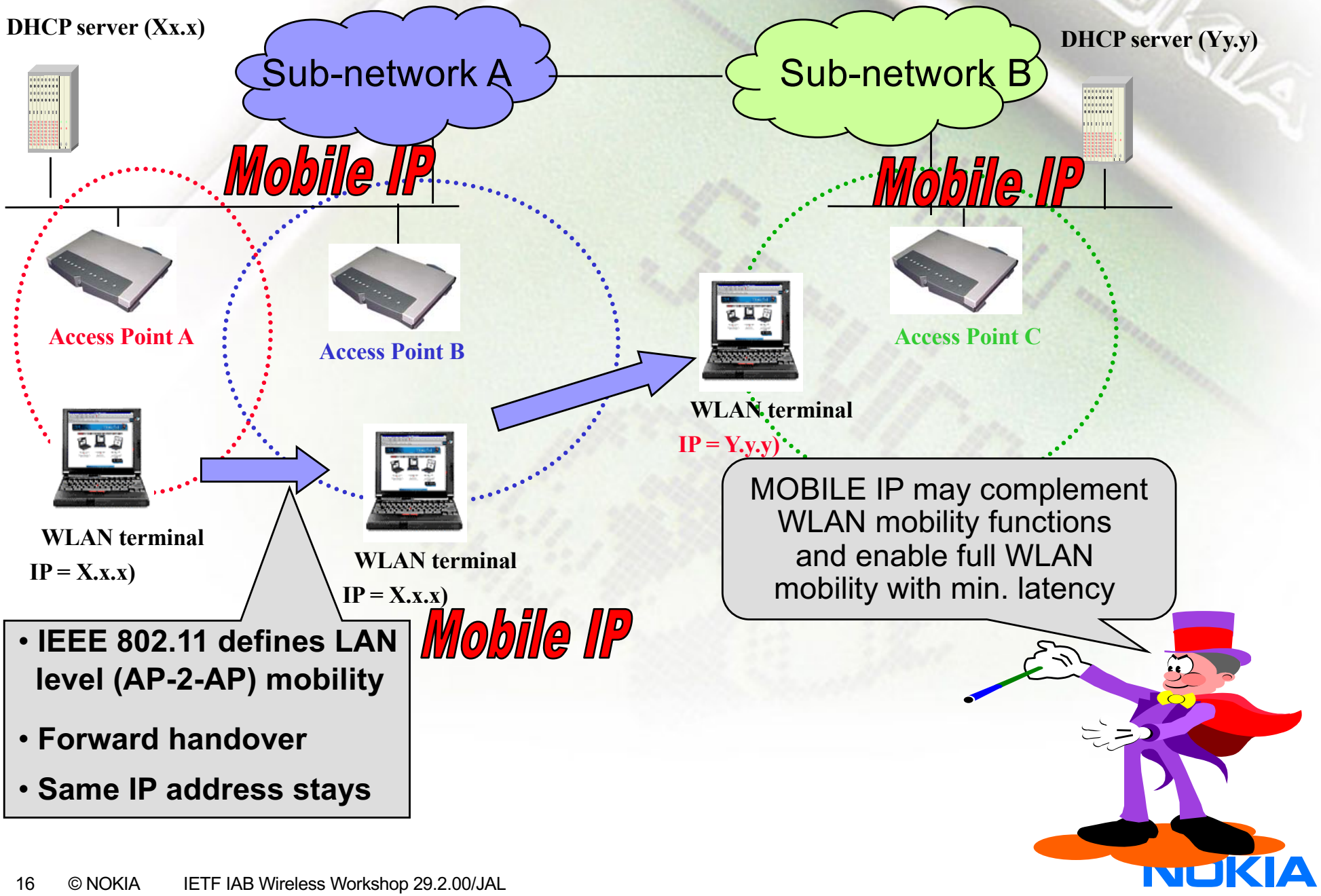
NOKIA

Multiple Authentication Needed...



NOKIA

Essential WLAN Mobility Support…



Wireless Quality of Service in WLANs

Current WLAN devices mostly used for best effort data transmission, but later in the future…

… WLANs should support also wireless voice -> radio link QoS is essential

… Operators would like to apply traffic based billing -> QoS support needed

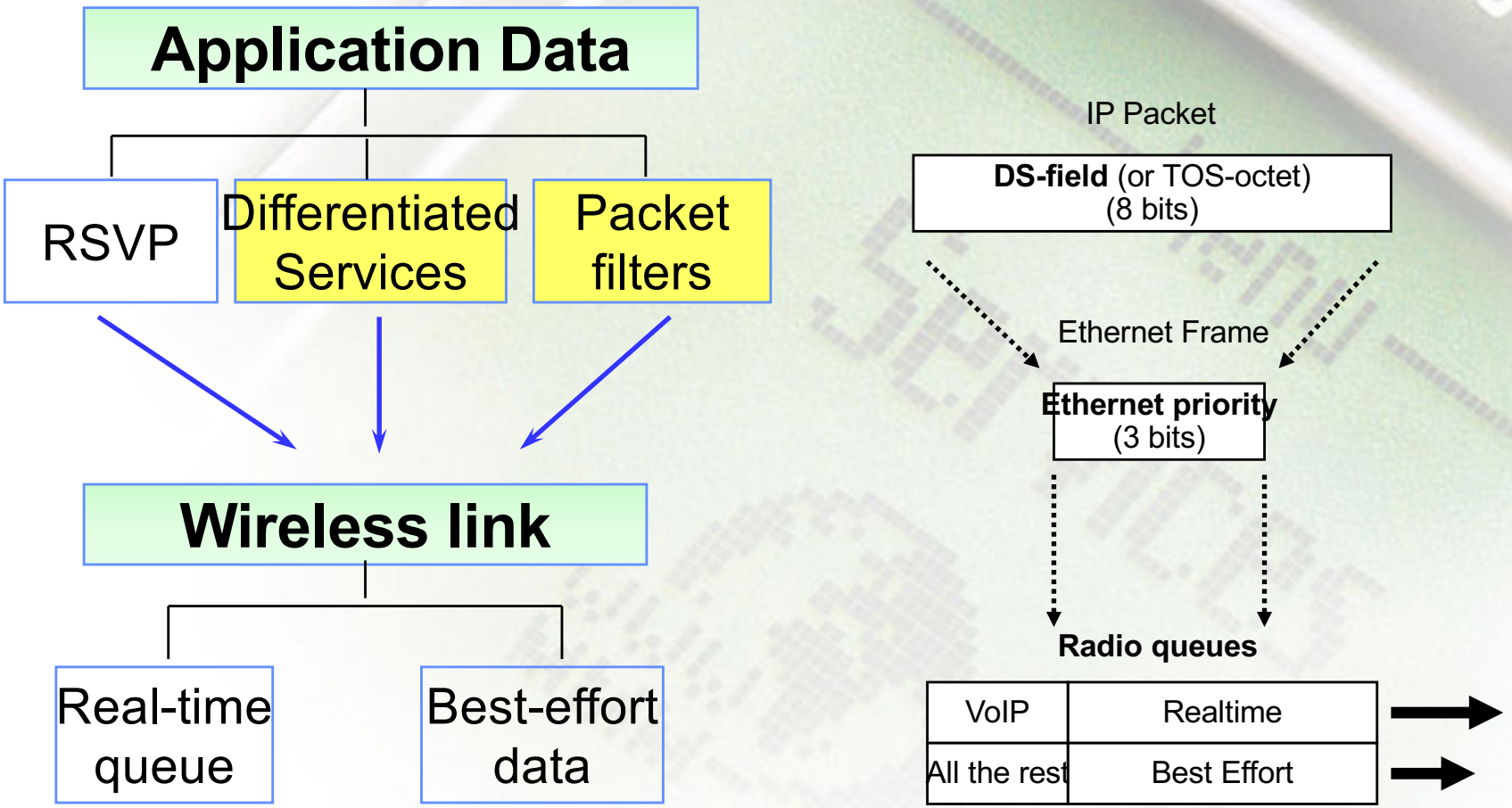
NOKIA

Findings Related to QoS and VoIP

- NAT is a real problem as it breaks QoS reservations
- VoIP DOES NOT WORK WITH NAT -> goes beyond all QoS problems!!!
  - IPv6 would be natural solution
- RSVP is complex -> hard to adopt
- Diffs seems best solution for wireless IP link
  - Straightforward mapping
- Wireless TCP problem and header compression needs to be studied and standardization efforts are to be expected

NOKIA

Mapping IP QoS into Radio Link



WLAN QoS resembles 802.1p&Q approach:

- Separate radio link queues and priority scheduling
- IP packet filters and Diffs bits define the queue

NOKIA

Summary
- The Desired IP Architecture Model -

Layered View: Native IP Interworking

Applications

IP routing & QoS

IP level authentication (AAA + PKI)

IP (+ IP mobility? + IP security? + IP/GPRS billing?)

Seamless Interworking

NOKIA

Hmm...
How Does This Fit into Future Cellular Mobility Management?

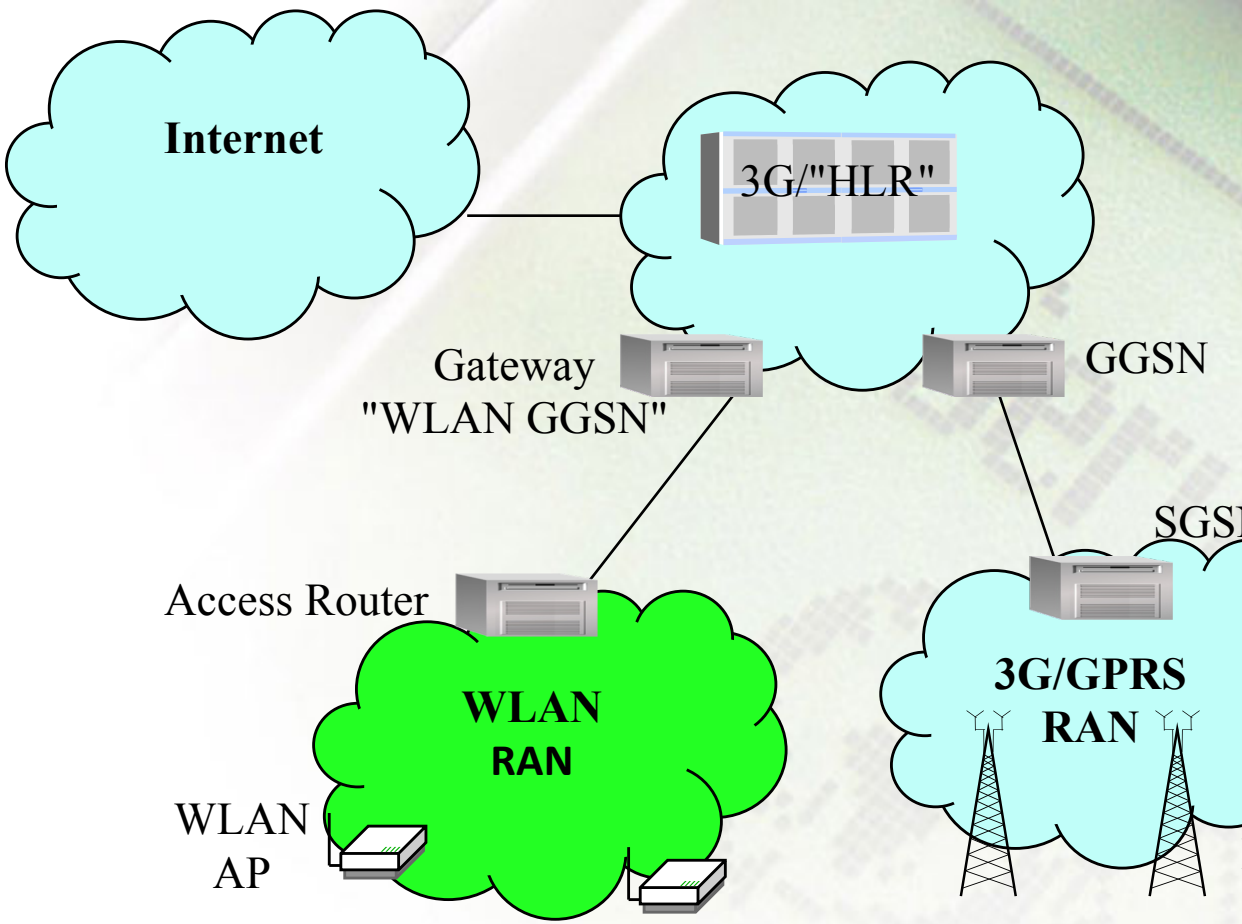
1) 3G & WLAN Integration

2) 3G & WLAN Interworking

Focus on authentication and mobility

NOKIA

3G & WLAN integration



Summary of features:
- Integrated authentication and billing
- WLAN security and mobility with IP terms
- AAA work is a must!!!

Multimode terminal
with **3G user identity**

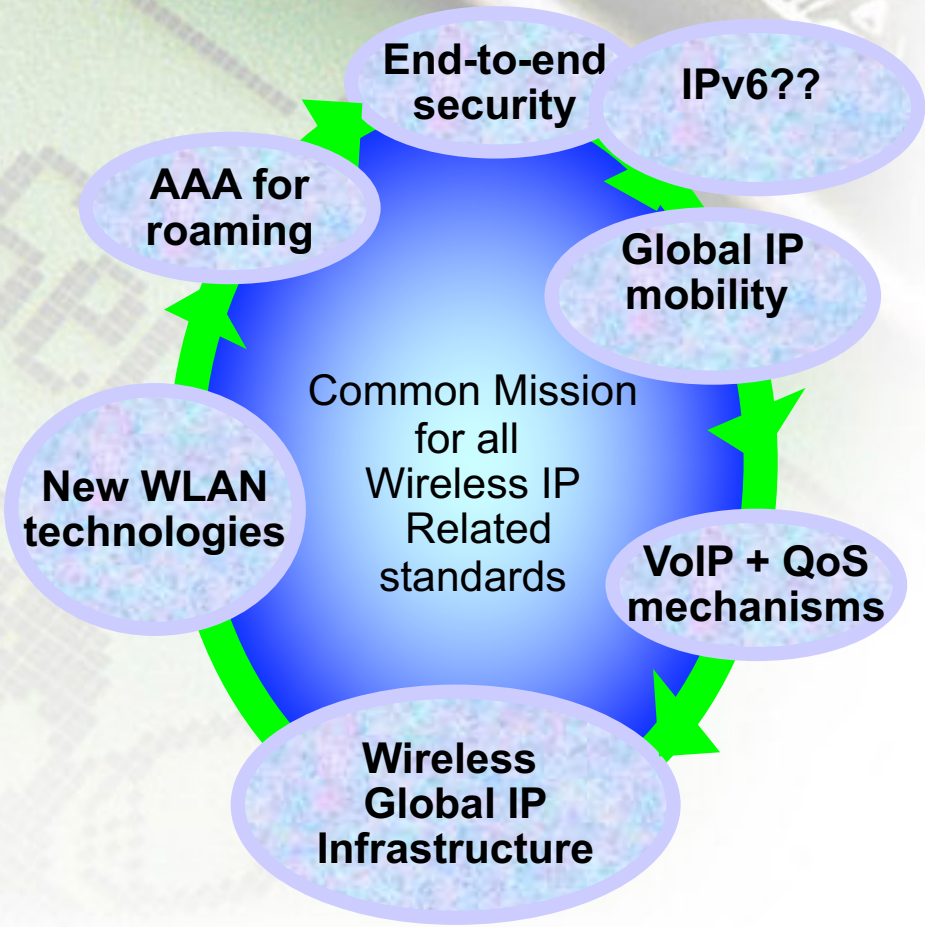
NOKIA

What We Should Do to Make Dream True?

- Challenges for IETF work -

Summary and "Wishes" for IETF

- WLANs first implemented as wireless IP extensions, WLAN - cellular interworking possible later
- IEEE 802.11b is "leading" standard
- WLANs should support data and VoIP services -> avoid NAT
- Global IP mobility and AAA infrastructure are missing pieces of IP roaming
- IPv6 solves most of the listed obstacles with native mobility and security -> should be adopted
- IETF standardization should consider the requirements of roaming and ad-hoc networking



NOKIA