

# WINLAB Research Summary IAB/Research Review Oct 29 & 30, 2001



Rutgers University

[www.winlab.rutgers.edu](http://www.winlab.rutgers.edu)

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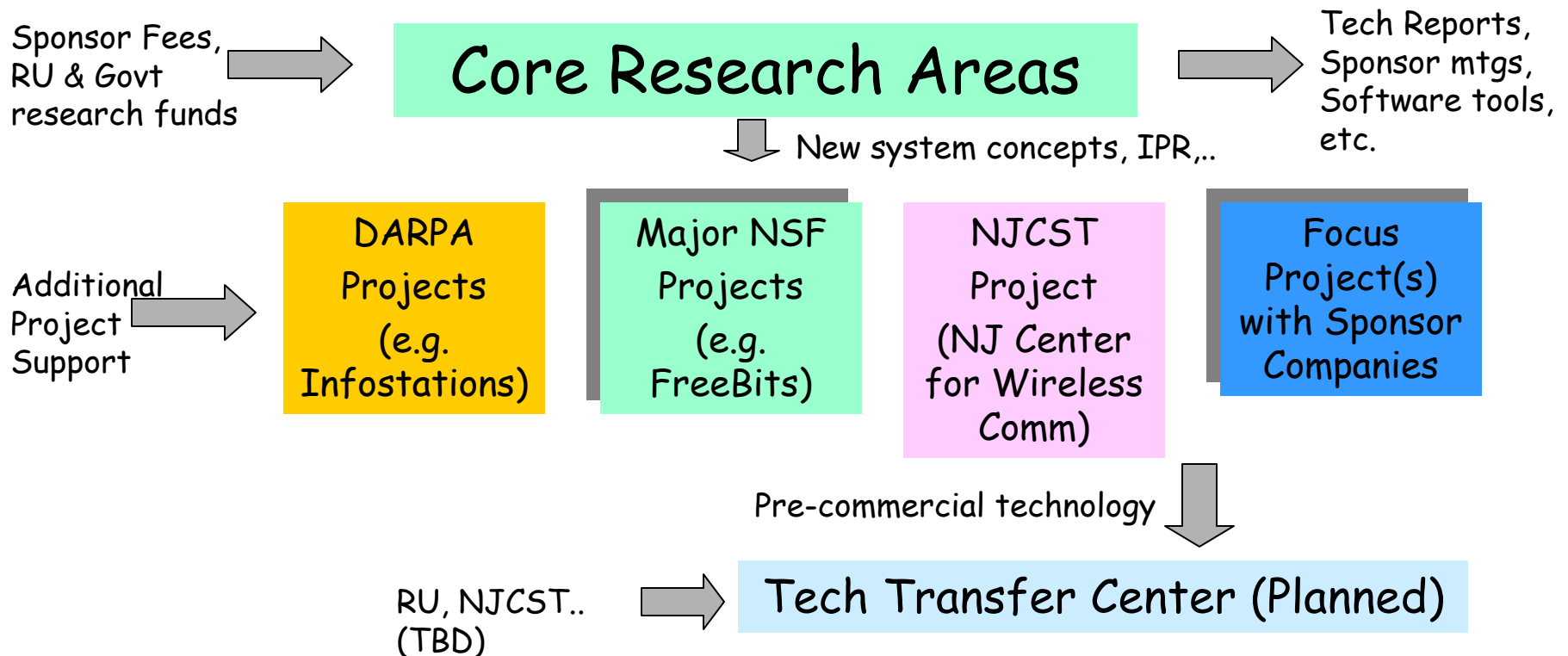
# Wireless Information Network Laboratory

- Cooperative industry-university research center at Rutgers University, focused on wireless technology
- In operation since 1989, with a strong track record of research contributions to wireless data networking
- Research program a mix of core R&D, focus projects and industry collaboration
  
- ~20+ Industry sponsors, NSF, State of NJ, ...
- ~20 faculty/staff + ~30-50 students
  
- *...more details to be given during WINLAB strategic plan presentation at IAB mtg on 10/30*

# WINLAB Research Scope

- Wireless information networks from a systems perspective. Scope includes:
  - RF/modem technology
  - Wireless system-on-chip (SOC)
  - MAC/data link control
  - Radio resource management
  - Mobile network protocols
  - Mobile information services middleware
  - Mobile computing software & applications
  - Wireless system architecture
- WINLAB has pioneered wireless data system design for over 10 yrs, and looks forward to being a major force in pre-competitive R&D for the emerging mobile Internet...

# WINLAB Activity Model



# WINLAB Core Research Areas

Basic  
Radio/  
Modem  
Technology

Radio  
Resource  
Management  
& Wireless  
Systems

Mobile  
Network  
Architecture  
& Protocols

Mobile  
Computing  
Middleware &  
Applications

## Faculty:

Y. Lu  
J. Evans  
P. Spasojevic  
L. Greenstein (Adjunct)  
J. Lin (Adjunct)  
+ TBH

R. Yates  
C. Rose  
N. Mandayam  
S. Mau (Post-Doc)  
D. Frenkiel  
Z. Gajic

D. Raychaudhuri  
P. Bhagwat (Adjunct)  
I. Seskar (Res Eng.)  
M. Ott (Adjunct)  
...+ 2 TBH

B.R. Badrinath  
T. Imielinski  
H. Hirsh

# Mobile Internet Research: Strategic Themes (near-future)

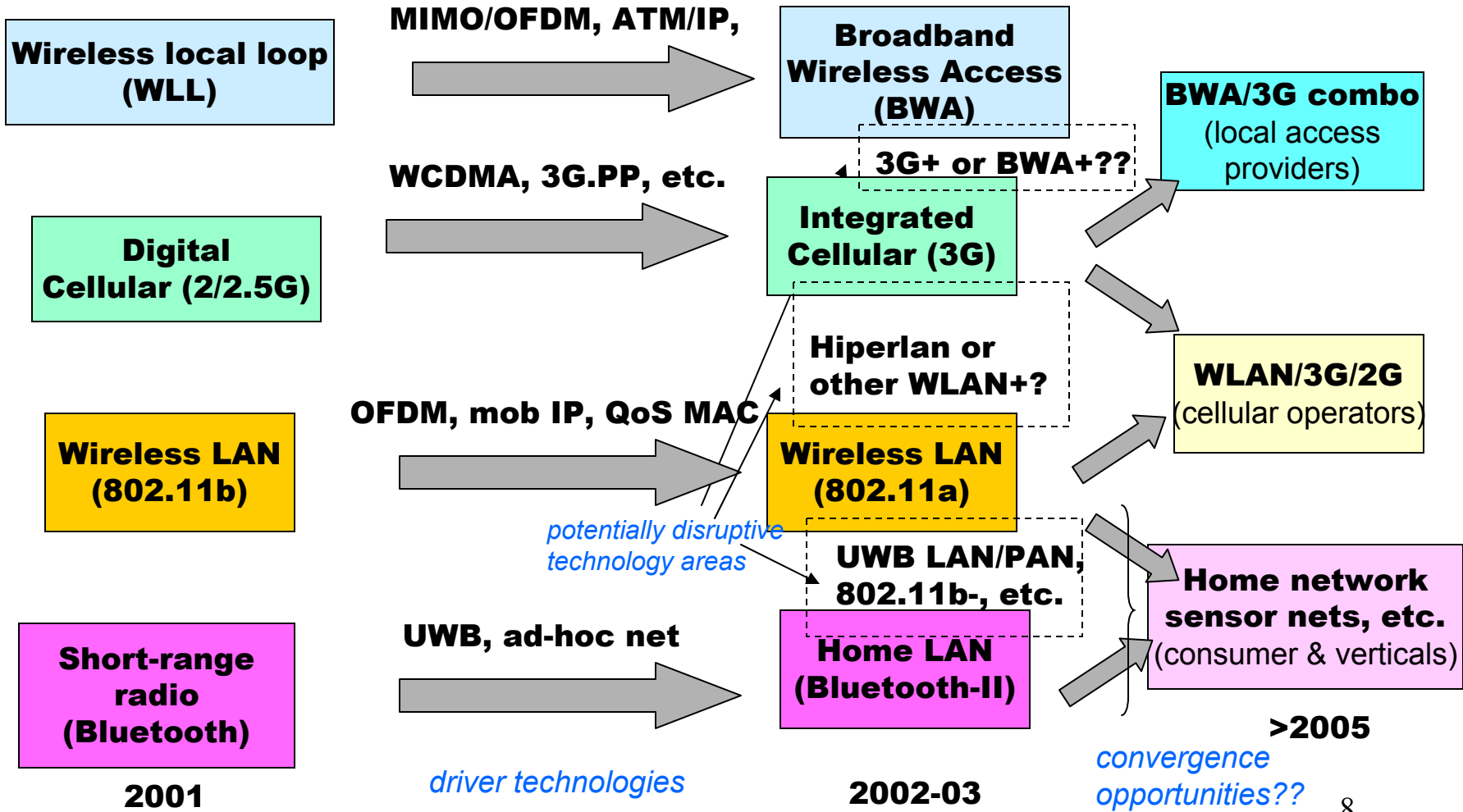
Several fundamental problems need to be solved before the mobile Internet can take off:

- Developing PHY/MAC for broadband radios
  - *~Kbps → Mbps → Gbps, adaptive, robust, QoS,...*
- Scaling wireless system capacity
  - *widespread service implies ~Gbps/Sq-Km*
- Designing wireless system-on-chip (SOC)
  - *low-cost/low-power, integrated CMOS*
- Unifying wireless network architectures (WLAN/IP, 2.5G, 3G cellular) & protocols
  - *multiple radio technologies, faster/simpler standards process*
- Creating “useful” mobile information services
  - *...beyond web browsing on hand-held devices*

# Mobile Internet Research: Strategic Themes (long-term)

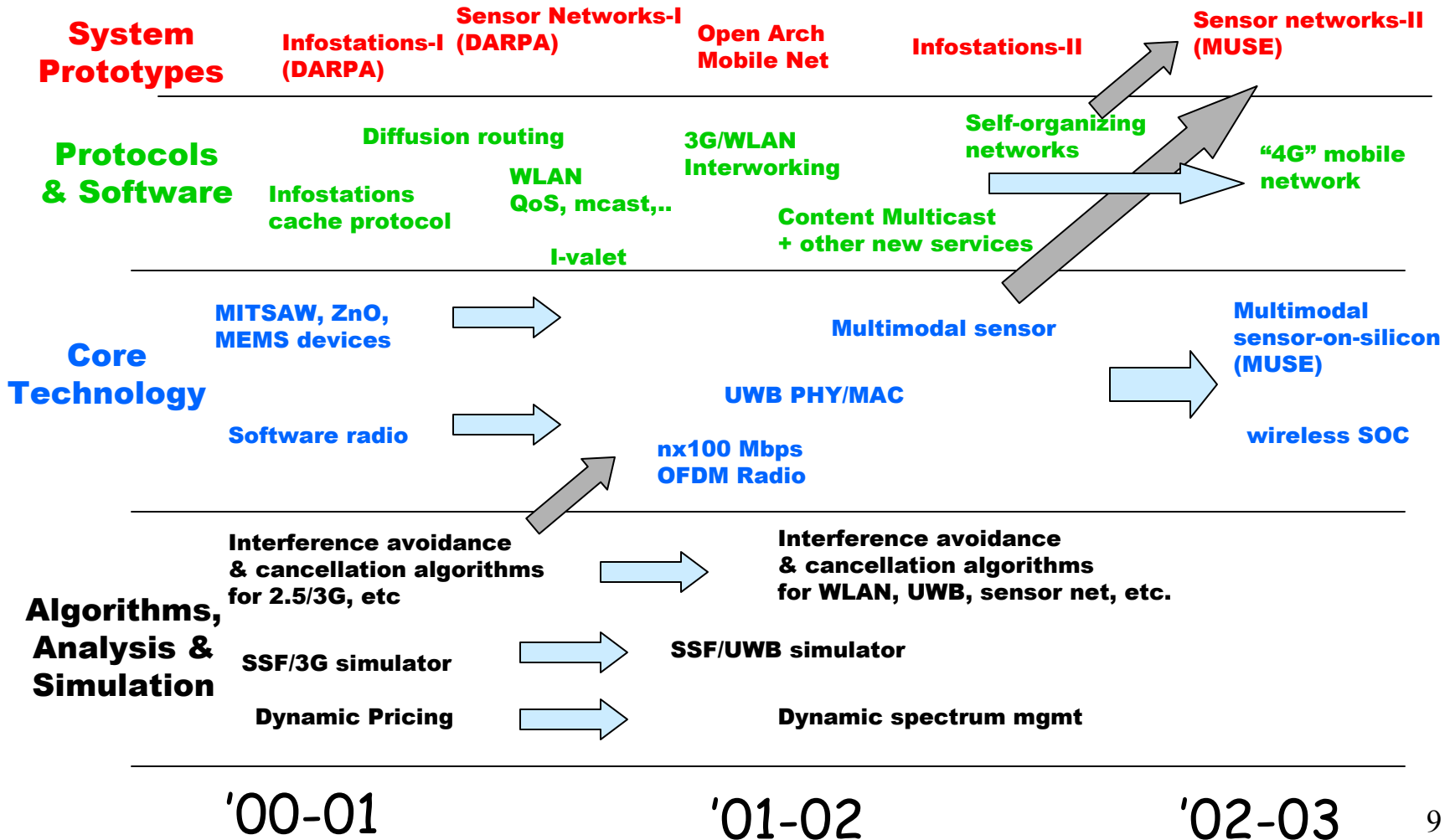
- Pervasive computing (connecting people with their physical environment) viable in 5-10 yrs
- Technical challenges:
  - *self-organizing (ad-hoc) networks*
  - *low-power/low-cost/multipurpose wireless sensors*
  - *scalable network routing and content distribution*
  - *distributed information processing in the network*
  - *end-user interfaces & applications*
- Above topics involve wireless, but are also inherently interdisciplinary
- *Not too early for companies to start thinking about products in this space...*

# Wireless Product Evolution





# WINLAB R&D Map



# Core Research: Radio/Modem & SOC Technology

- RF devices & sensors
  - *Lu, Lin*
- Wireless system-on-chip (SOC)
  - *Lu, Lin, Raychaudhuri*
- Software Radio Testbed
  - *Seskar, Mandayam, Rose*
- Radio modems (CDMA, OFDM, UWB,..)
  - *Evans, Yates, Rose, Mandayam, Spasojevic, Greenstein*

# Core Research: Radio Resource Management

- Interference Avoidance/Suppression
  - *Rose, Mandayam, Yates*
- SSF simulation for WCDMA, EDGE
  - *Mandayam, Yates*
- Dynamic Pricing/Resource Mgmt
  - *Mandayam, Yates, Mau*

# Core Research: Mobile Network Protocols

- WLAN enhancements & interworking with cellular/Bluetooth
  - *Seskar, Bhagwat, Raychaudhuri*
- Open-architecture IP-based mobile network for 3G.PP, WLAN, etc.
  - *Ott, Seskar, Raychaudhuri*
- Content-driven multicast routing for real-time mobile information services
  - *Hirsh, Raychaudhuri, Ott*

# Core Research: Mobile Computing

- Infostations services
  - *Badrinath*
- Digital sprinklers (sensor net)
  - *Badrinath*
- DataMAN
  - *Imielinski, Badrinath*
- I Valet, content/location aware applications
  - *Hirsh*

# WINLAB Focus Projects

- Infostations (DARPA, '98-'01)
  - Multi-disciplinary system project involving several CS & ECE faculty. PI's: Badrinath, Frenkiel
- FreeBits (NSF, '00-'02)
  - Collaborative program (with Princeton & NJIT) involving both theory & prototyping. PI: Yates
- NJ Center for Wireless Communications ('00-)
  - State-funded center-of-excellence involving Rutgers, Princeton, NJIT and Stevens
- Several new focus projects (UWB, MobNet, Sensor-on-Silicon, dynamic spectrum mgmt) being scoped with govt agencies and sponsors<sub>14</sub>