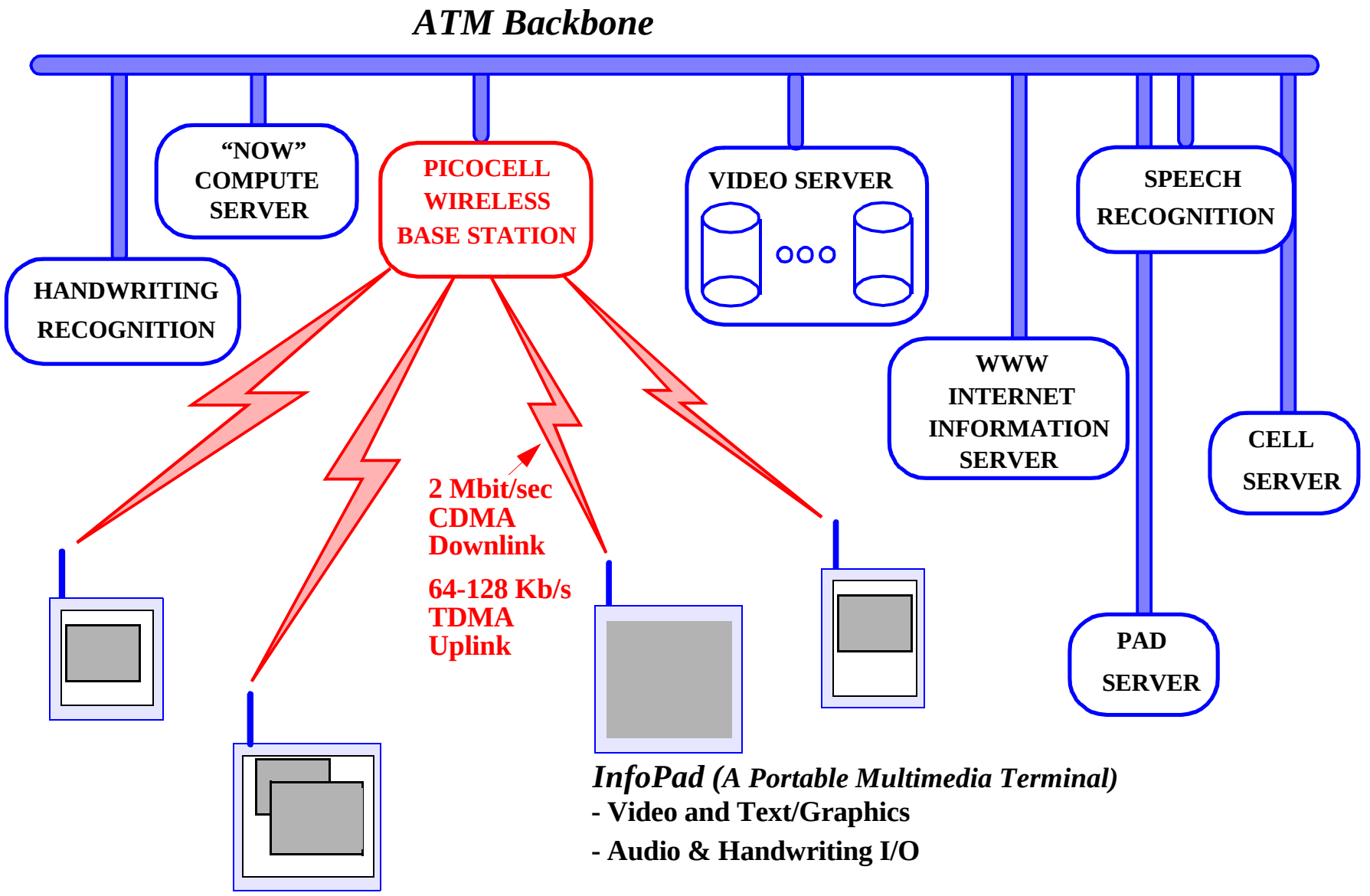
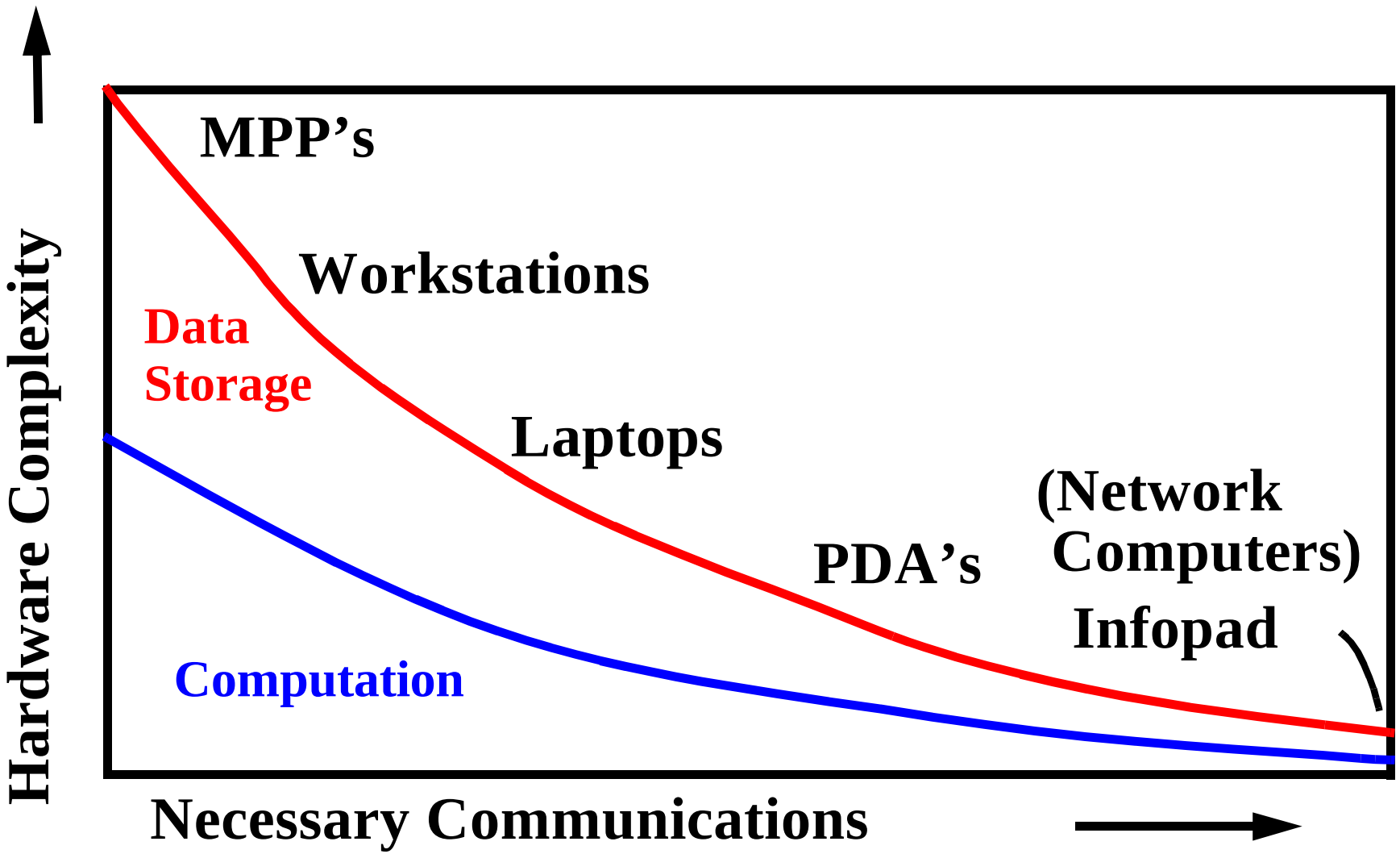
The Infopad Project



7 Areas of the InfoPad Project

- Padgroup - Terminal and basestation
- CDMAgroup - Downlink system design
- RFgroup - Integrated CMOS RF circuit design
- Infonet - Network support for mobility
- Medley - Backbone network servers and protocols
- UIgroup - Applications and middleware
- Infodesign - System and low power design support

Computation/CommunicationTrade-offs



Argument for InfoPad as an I/0 device

- Reduces power, size and ***cost*** for the user to the maximum extent possible
- Information access is the primary application and the data is largely time critical or from large data bases
- Simplifies use by eliminating user support of system software
- The wireless link has high error rates that best supports robust, transient I/O data

InfoPad and "Network Computers"

Network Computer

- A fixed network attached I/O device for viewing and manipulating information
- Low cost (<$500)
- Easy to use

InfoPad

- All the above

+

- Portability -> Low power and small size
- Wireless communications
- Network infrastructure to support mobility and Quality of Service

Goal of the Present Project

To implement a wireless computing environment which will allow 50 users in a confined area to simultaneously access and communicate with multi-media network services using a low cost, light weight portable tablet.

November 1995 Demonstration

Accomplishments

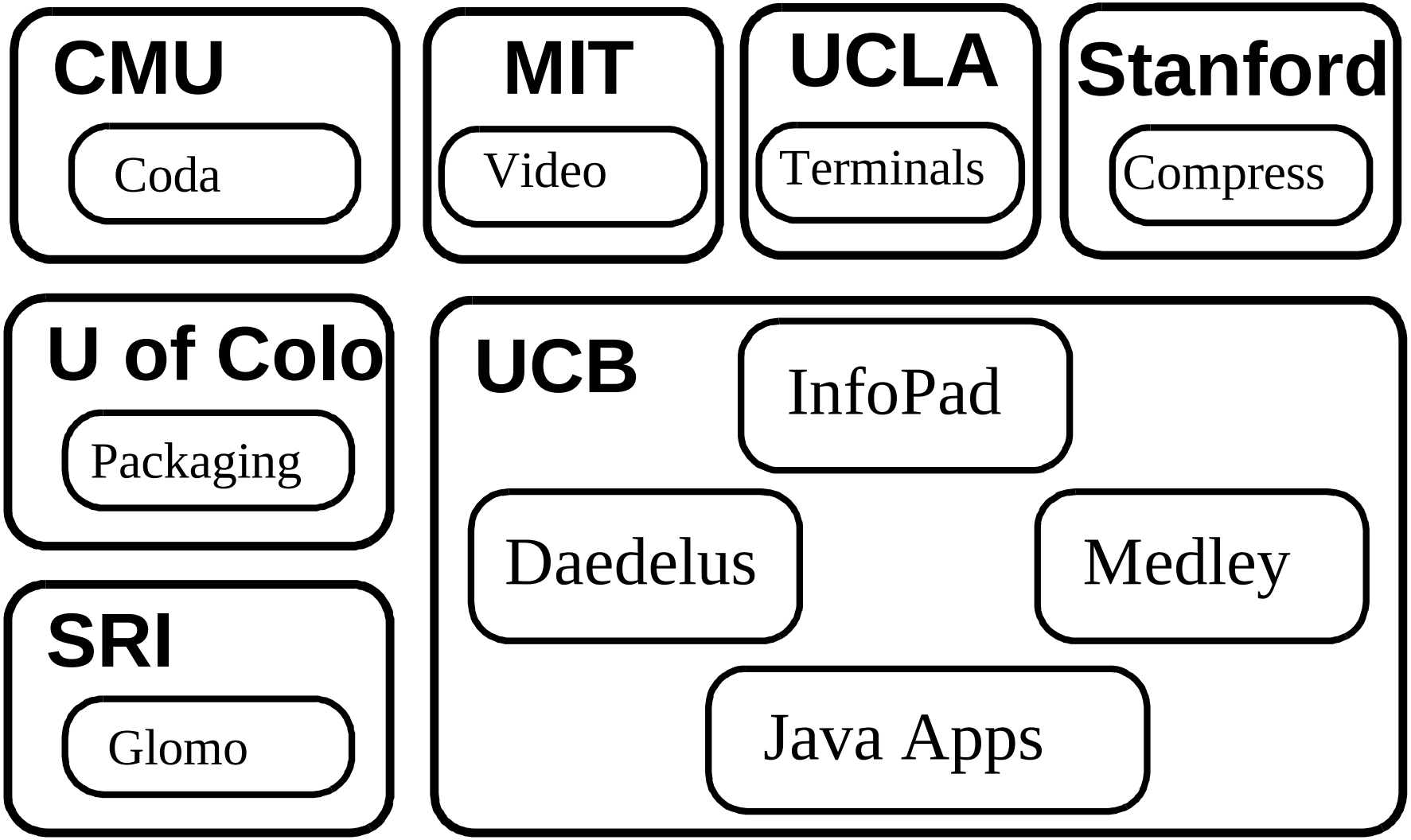
- **COMPLETE SYSTEM WAS DEMONSTRATED** (just-in-time). Connectivity from InfoPad aware applications, through the Infonet mobility support, basestation, radio link and finally to the hardware pad.
- 10 new pads have been built (4 at the time of the demo)
- 4 new base stations

Why Build an Entire System?

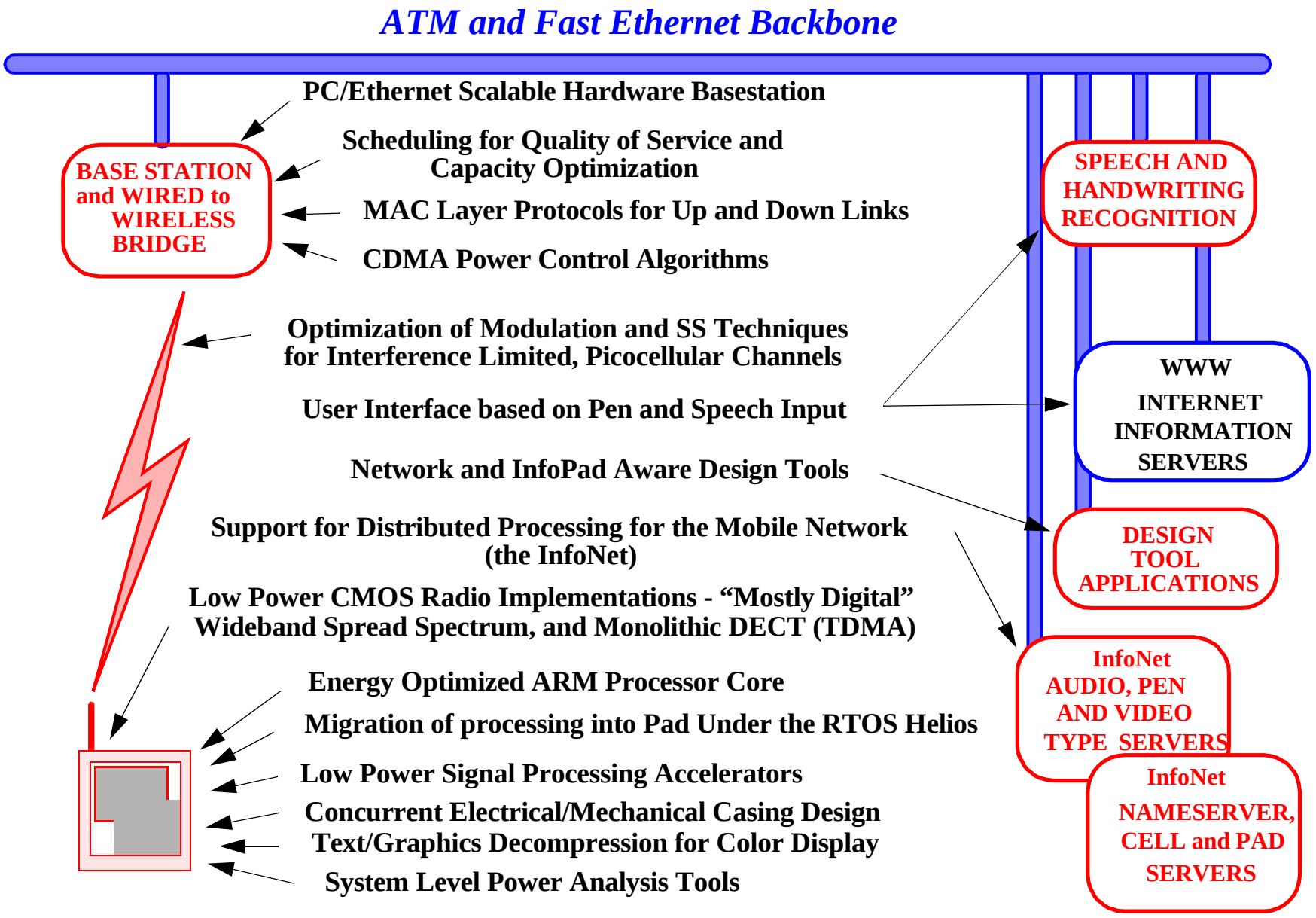
Though demonstrations are important, the real purpose of the InfoPad project is the research that it facilitates.

- Joint research with other Universities and Industrial labs - (eg. new National Semiconductor Research Lab - transfer of software and hardware)
- Supporting over 40 student projects

Integration with other University Research Projects



The Individual Research Projects



What's next?

The 3 year initial project is finishing at the end of this year.

Two new thrusts:

- Low power design for programmable components (both software and hardware programmable)
- Extension of the InfoPad System design to be more flexible and adaptable to varying wireless links and pad functionality with the lowest possible energy consumption

Future Directions

Investigate the communications vs. computation tradeoff for communication links with bandwidths from 10kHz-1MHz

Issues

- What kind of processing in the pad is most effective in reducing communication requirements
- How to retain advantages of the InfoPad system architecture, while increasing pad computation capability
- How to implement processing with the lowest possible energy, while providing high performance when required

Future Directions

Implement a software infrastructure which allows seamless mobility over widely varying communication links, while optimizing the capacity and quality of service for all users

Issues

- From the system viewpoint, where is QOS support required and what are the “knobs” that should be controlled
- What kind of support can be given in the radios and the pads for controlling the QOS
- What is the impact on the applications of an underlying variability in the bandwidth of the communication links

Future Directions

Incorporate programmability into the wireless communications link at lowest possible energy cost

Issues

- Extend “Mostly Digital” approach for wideband radio to other spread spectrum modulation schemes
- Extend CMOS DECT implemention to have multimodal radio capabilities supporting standard protocols (eg. GSM)
- Determine array structures for implementing low power, field programmable logic for flexible high rate baseband processing (eg. timing recovery)

Future Directions

Demonstrate system level solution to low power design for the pad, while increasing its flexibility

Issues

- Reduce total weight and power to 1-2 lbs and 1-2 watts even with a high resolution color display (2-3 years)
- Optimize energy reduction over all aspects of pad design through use of new tools for power analysis and optimization
- Implement a modular pad architecture (physical and electrical) to allow flexibility in pad capabilities

Conclusions

- Conventional wisdom has taken a step towards the InfoPad system design through the acceptance of the “network computer”
- Implementation of the complete InfoPad system has provided:
  - An infrastructure within which to do research on mobile computing
  - Provided a focus and motivation to try out new ideas in a variety of areas
  - Given students managerial and project experience