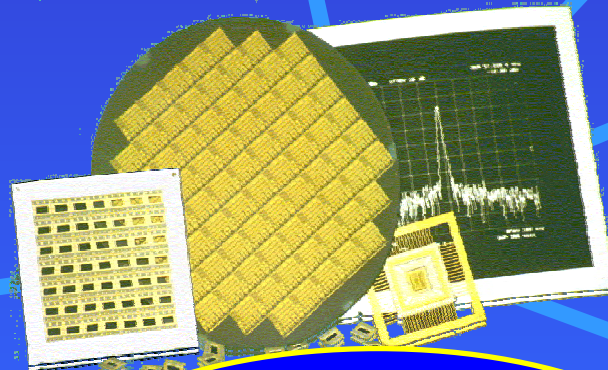




True Software Definable Radio



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Wireless Communication Timeline

- 1879 – Physicist David Edward Hughes demonstrates one of the earliest Spark Gap Transmitters (the technology used in Marconi systems).
- 1902 – R. A. Fessenden suggests radio telephony using continuous waves.
- 1912 – First transpacific radiotelegraph service links San Francisco and Hawaii. RMS Titanic uses the distress calls “CQD” and “SOS” after striking an iceberg.
- 1927 – Philo T. Farnsworth patents the “image dissector” (television).
- 1939 – RCA launches commercial television.
- 1947 – First car mobile phones appear.
- 1948 – Community Antenna TeleVision (CATV) is launched.
- 1960 – First communications satellite (Echo I) is launched.
- 1973 – First portable mobile phone (Martin Cooper – Bell Labs)
- 1976 – HBO moves to satellite.
- 1977 – Prototype cellular system.
- 1980s – Satellite TV gains popularity.
- 1984 – Bell Telephone divestiture.
- 1990s – Commercial Internet
- 1996 – Telecommunications Act clears the way for Voice over IP (VoIP)
- 1999 – WiFi approved.
- 2000s – Commercial WiFi and VoIP services grow.



Some Observations

- In the 1910s and 20s traffic was scarce enough to allow using the airwaves as one big “party line”.
- In the 1930s the emergence of commercial broadcast radio required partitioning the air waves by frequency.
- This access model continued in the 1940s, 50s, and 60s with the emergence of television.
- The emergence of cellular services (1970s) required the use of frequency (later code) and time multiplexing to accommodate a large number of transmitters.
- With the continued migration of users from a fixed to a mobile access model, more efficient uses of the radio spectrum will be required.
- This is ironic, since the airwaves are once again evolving toward becoming a party line. Our challenge is to develop simple “etiquettes” for their use.



®

Telecommunications Industry

- In a state of technological disarray
 - Competing protocols, frequencies, data rate standards, incompatible technologies
- Carriers and Network Operators
 - Have to keep pace with unprecedented demand for wireless connectivity and services, through:
 - Deployment of new base stations with latest technology
 - Retrofitting existing networks
 - Spend billions of dollars in upgrades and maintenance



The Solution

- **A Wireless Communications Processing Unit**
 - Replacing conventional analog circuitry with software driven digital signal processing.
 - Simultaneously extracting modulated waveform from an incoming wireless signal and digitizing it with extremely high resolution.
 - Enables previously unimaginable architectures for directly digitizing wireless waveforms.

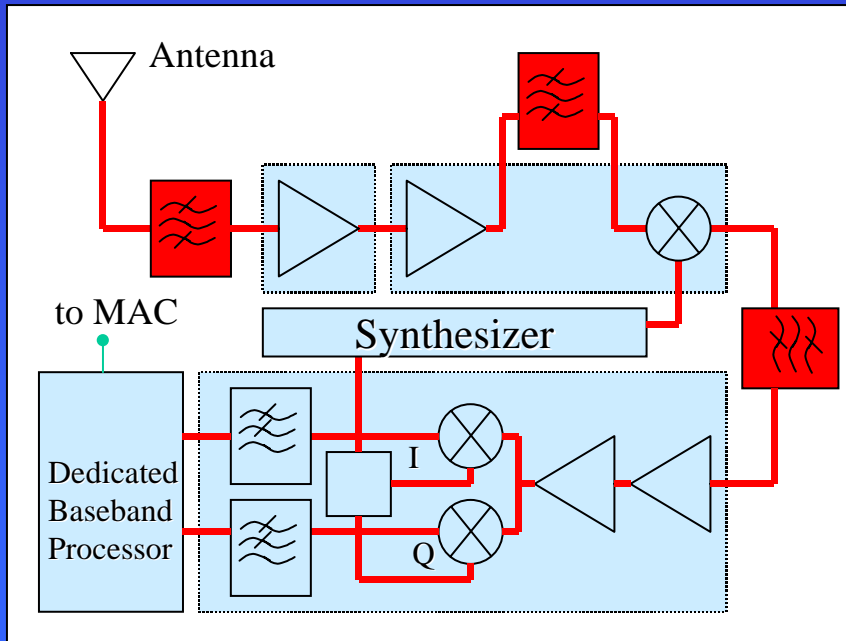


Comparison of Wireless Technologies

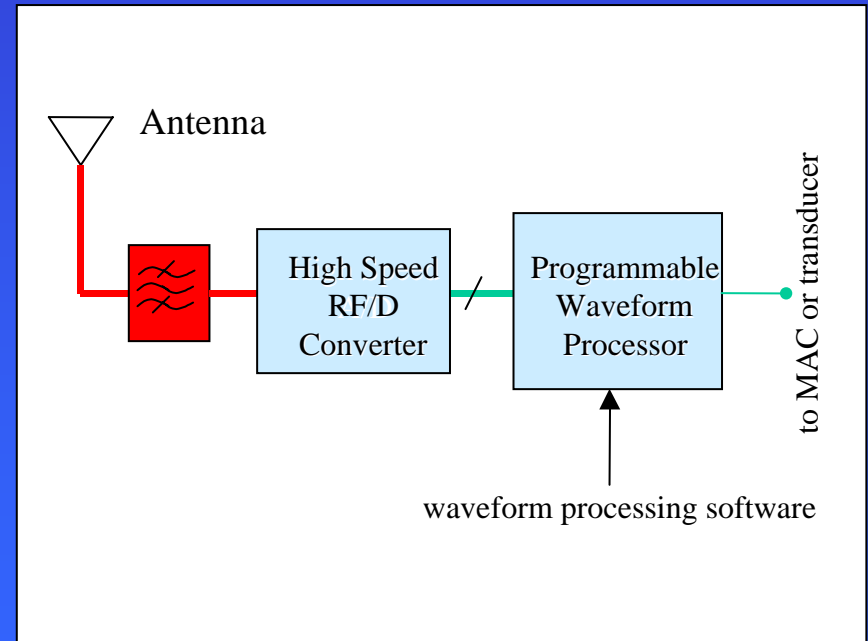
	Conventional Technology	Software Defined Radio	TCI True Software Radio
Protocol Agnostic	No	Yes	Yes
Limitlessly Frequency Agile	No	No	Yes
Wideband Capability	No	Limited	Yes
Only One RF Interface on PCB	No	No	Yes



Comparison of Direct RF/D Conversion to Conventional Receiver Approach



Conventional Analog Solution



TCI's WCPU Solution



The Software Radio Mission

- Short term – serve as an enabling technology for faster time to market, new services.
- Medium term – serve as a bridge between previously incompatible networks.
- Long term – serve as an enabling technology for the ultimate evolution of packet switching (time, frequency, and spatial diversity).