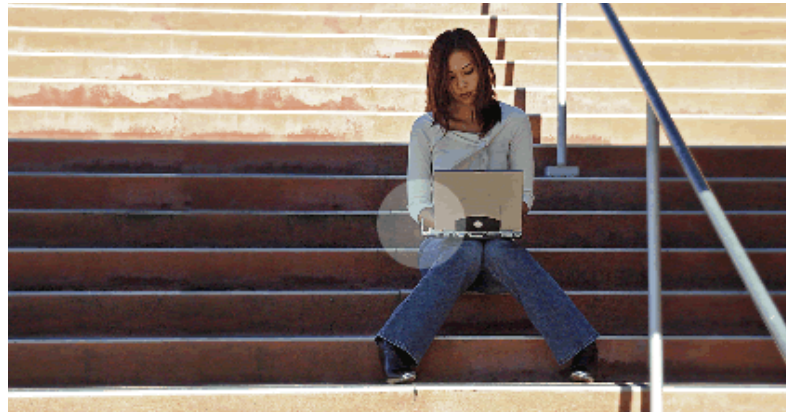


ArrayComm®

多天线信号处理

2007年3月29日



A Y G O M I C O M P A N Y



议程

- **ArrayComm** 公司简介
- 多天线信号处理：现状与展望
- 无线系统研发：你准备好了吗？
- 讨论

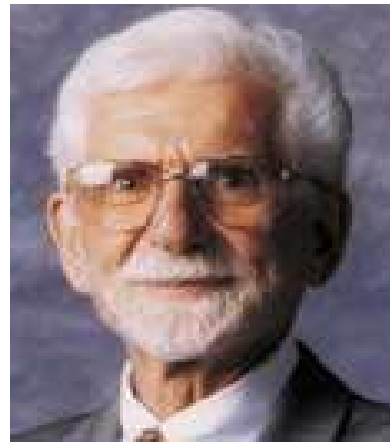


ArrayComm 简介

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ArrayComm的诞生



移动通信先驱Marty Cooper

创业家Arnaud Safari

斯坦福大学毕业的博士Richard Roy (ESPRIT 算法发明者)



ArrayComm简介

- 1992年成立
- 专注于多天线信号处理技术研究开发
- 已成功地将多天线信号处理技术应用于：
 - ▶ WCDMA
 - ▶ GSM
 - ▶ PHS
 - ▶ iBurst (HC-SDMA, 802.20 TDD候选方案)
- 正在研发：
 - ▶ WiMAX
 - ▶ HSDPA/LTE

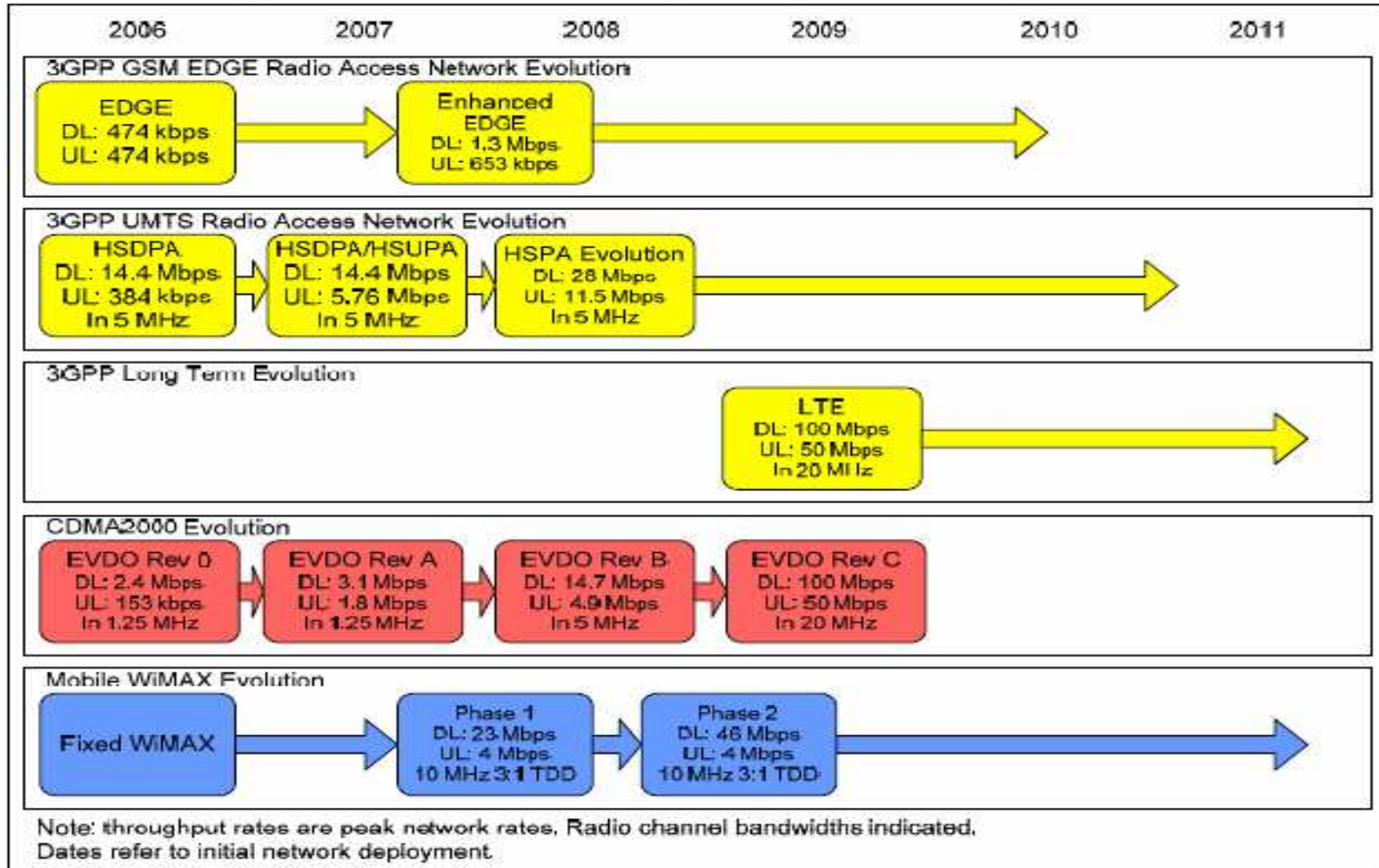
为什么在无线系统中要用多天线?

"Spatial processing remains as the most promising, if not the last frontier, in the evolution of multiple access systems."

-Dr. Andrew Viterbi, founder, Qualcomm

无线标准的演进路线

Figure 1: Evolution of TDMA, CDMA, and OFDM Systems



Source: 3G Americas Report "Edge, HSPA and LTE" September 2006

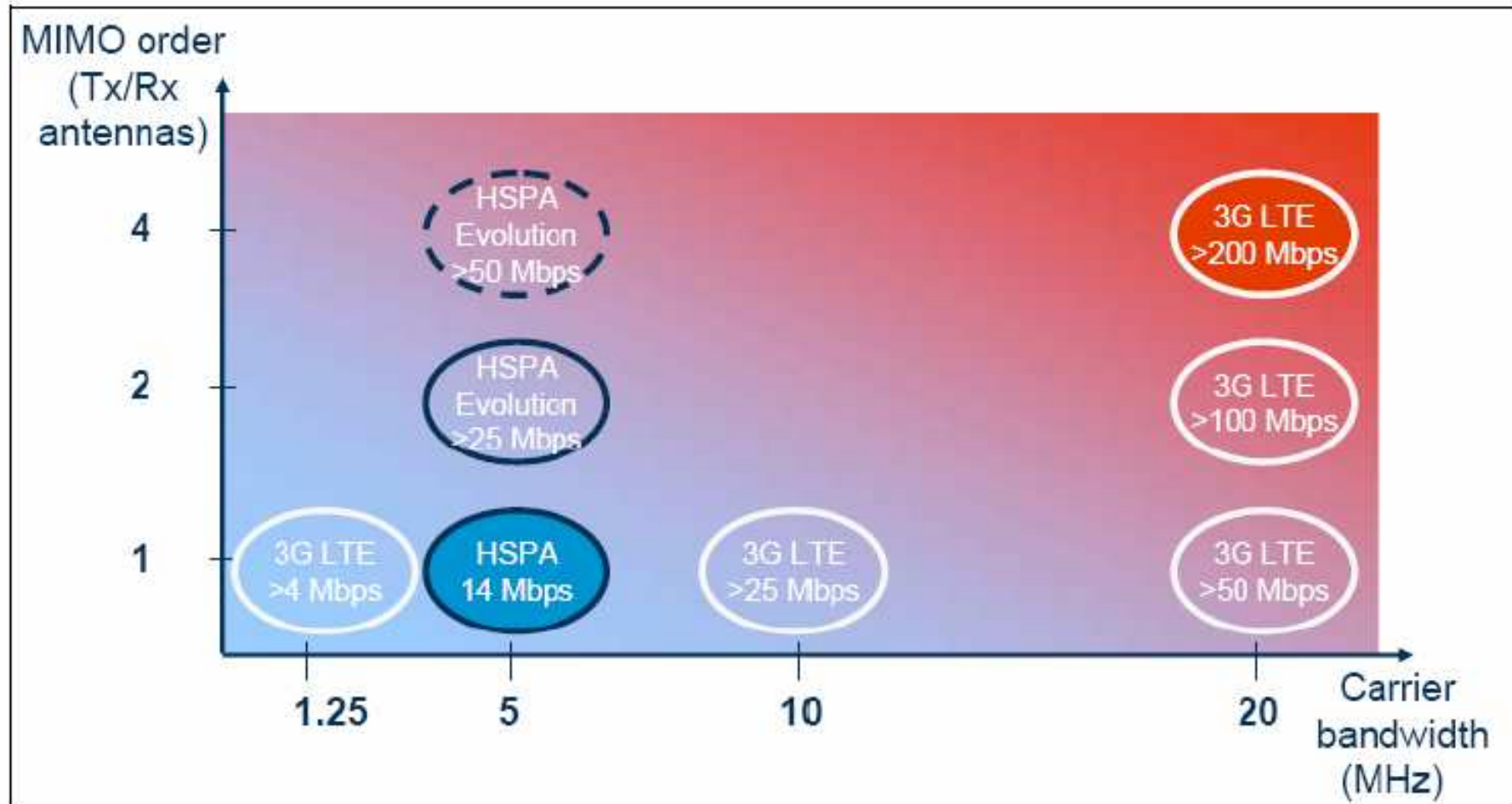
运营商们的迫切要求

- 提高系统频谱效率
- 提高用户感受到的数据率
- 提高现有系统和下一代系统的覆盖性能

怎样才能达到这些要求？

多天线技术是达到运营商要求的重要手段

Figure 14: HSPA, HSPA+ and LTE Performance Possible Peak Data Rates³⁵



Source: 3G Americas Report "Edge, HSPA and LTE" September 2006

为什么不提智能天线？

多天线信号处理的繁多种类

- 传统意义上的智能天线：简单的波束形成(需要天线间距为 $1/2$ 波长)
- Switched-beam
- 天线分集
- 自适应阵列天线
 - ▶ 干扰消除
 - ▶ Maximum Radio Combining (MRC)
- MIMO (Multiple Input Multiple Output)
 - ▶ 开环MIMO-STC (Space Time Coding)
 - ▶ 开环MIMO-SM (Spatial Multiplexing)
 - ▶ 闭环MIMO-终端反馈
 - ▶ 有干扰消除的MIMO-STC
 - ▶ 有干扰消除的MIMO-SM
- SDMA, CSM (Collaborative Spatial Multiplexing), Multi-user MIMO

SISO, MISO, SIMO, MIMO, ...



SISO

- ▶ Single Input, Single Output



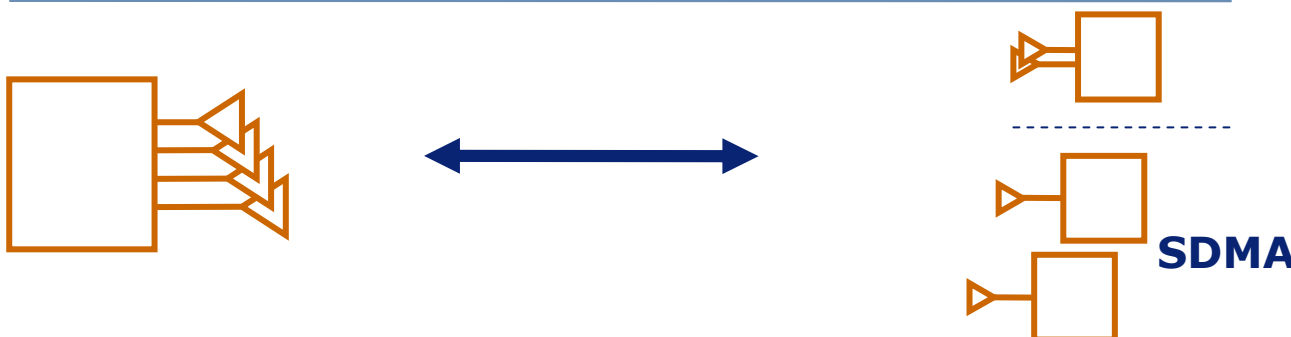
MISO

- ▶ Multiple Input, Single Output



SIMO

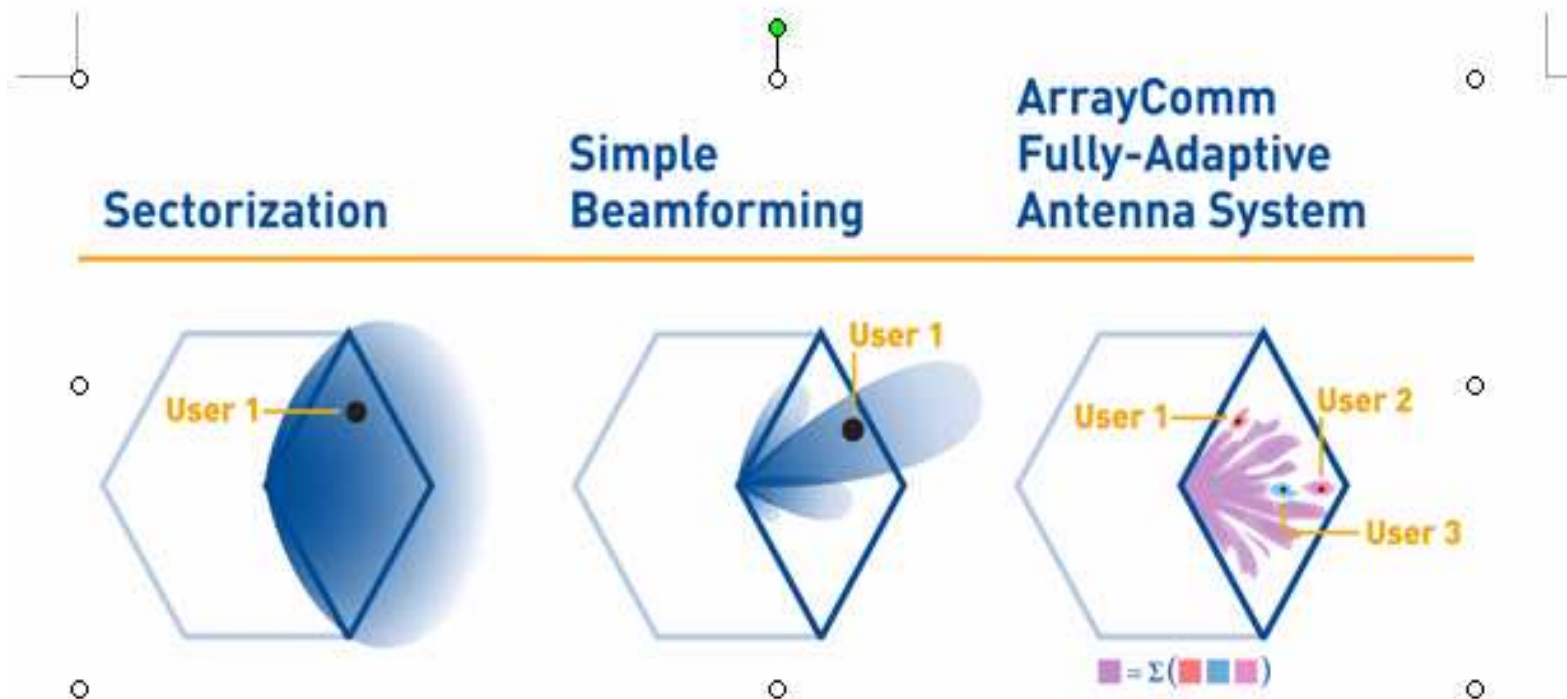
- ▶ Single Input, Multiple Output



MIMO

- ▶ Multiple Input, Multiple Output

波束形成与自适应干扰消除



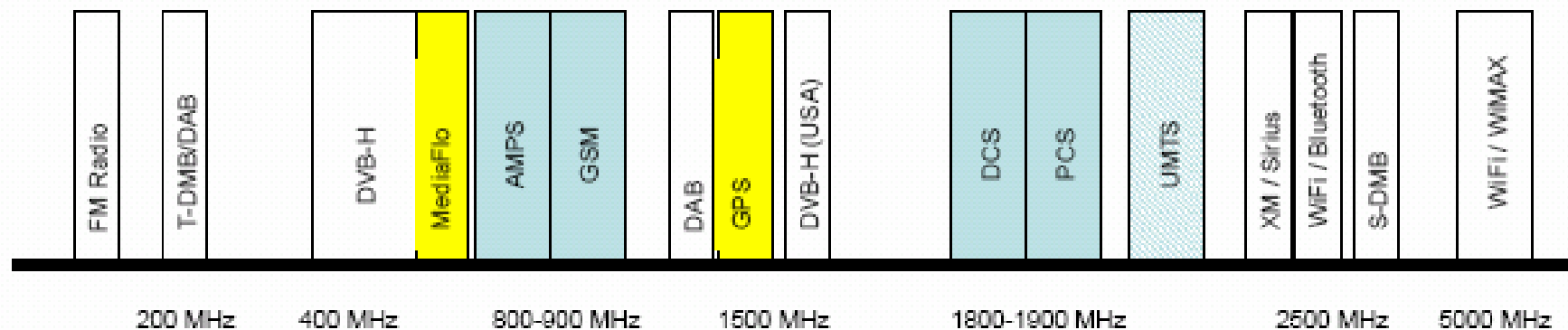
根据终端所处环境选择相应的处理算法

- 移动速度
- 场强/在小区的位置
- 干扰源的性质/数量
- 衰落
- 与自适应调制与编码方式协调
- 与功率控制协调
- PHY根据以上因素动态调整算法来获得最佳性能

多天线系统实例



移动终端中的多天线



Source: Ethertronics



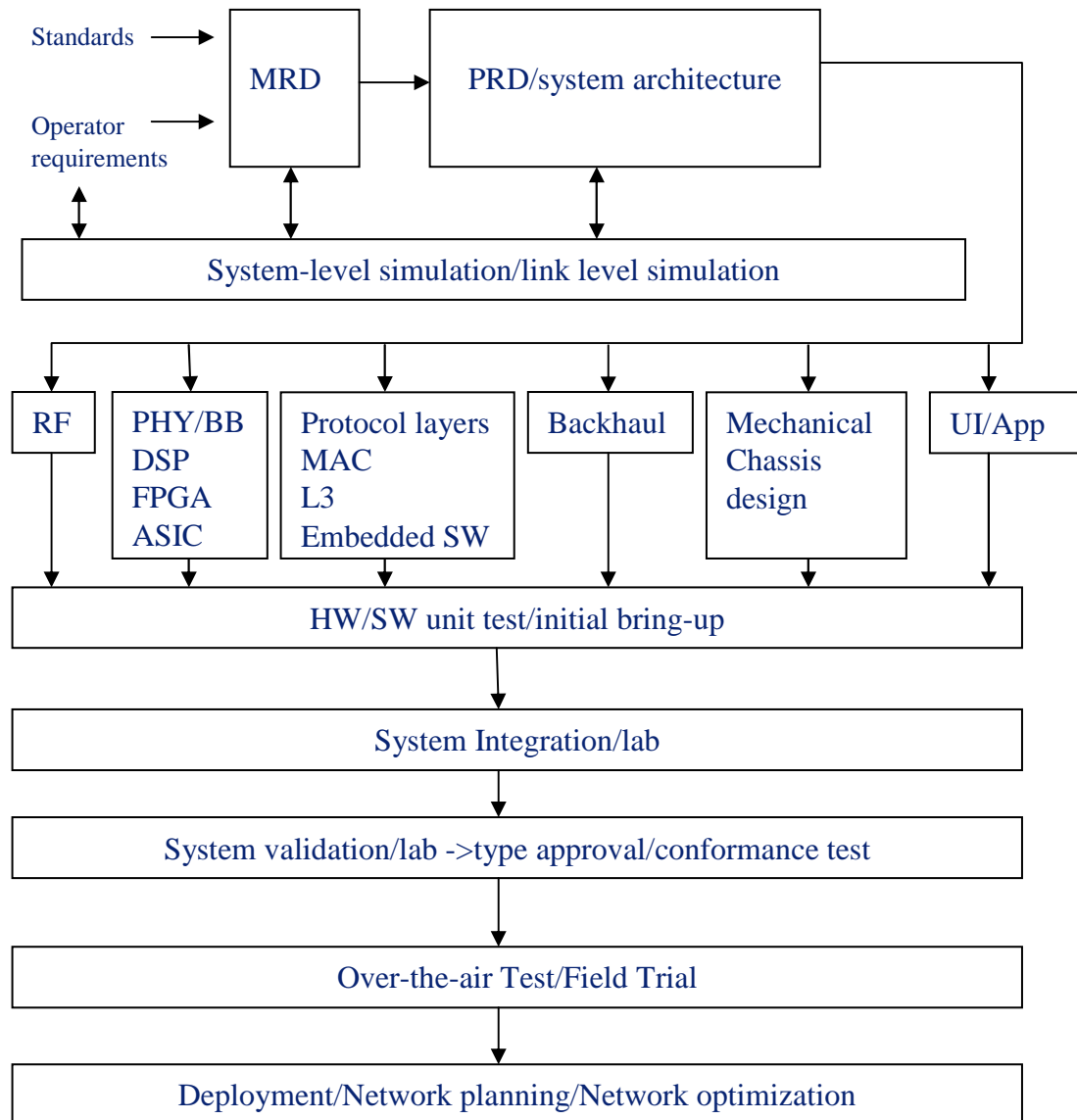
- HSDPA、EVDO 双天线接收分集已商用
- 3GPP 正在积极推动HSDPA双天线干扰消除
- 在下一代Edge终端中使用双天线
- 为支持R7 MIMO、LTE MIMO终端需要多天线



无线系统开发流程及职位介绍

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无线系统开发流程



- Technical marketing
- Product management
- Research/Algorithm Engineer
- Standards Engineer
- System Architect
- Digital hardware/FPGA design Engineer
- RF Design Engineer
- ASIC (Digital/RF/Mixed Signal) designer
- Software Architect
- DSP software engineer
- Embedded/protocol Software Engineer
- Systems Engineer
- Validation Engineer
- SCM engineer
- Mechanical Engineer/Designers



Thank You!

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