封面格式

行政院及所屬各機關出國報告

（出國類別： 考察）

（赴英、印訪廠執行無線通訊系統軟體技引案公差報告）

服務機關：中山科學研究院

出國人職稱：聘用技正

姓　　名：胡明德等三人

出國地區：英國、印度

出國期間：92年9月2日至92年9月11日

報告日期：92年9月23日

IO/c09300115

CSIPW-92C-H0002

國外公差報告

企劃處
5A01409200881

中山科學研究院

國外公差心得報告

批示				
中山科學研究院 副院長 宋				

公年度	92	所屬單位各級主管	會計品會	政戰部	企劃處
單位	電子系統所品後組 資通所精密電子組 資通所精密電子組				
級職	少校技士 荐任技正 聘用技正				
姓名	何賢奎 翁國執 胡明德	電子系統所所長 荊溪冀 電子系統所品後勤組長 田振揚	計畫品質審議委員會執行秘書兼組長 王 寬 計畫品質審議委員會策進委員 萬宗權 計畫品質審議委員會執行秘書兼組長 黃明揚	政治作戰部副主任 陳浩槍 保防安全組組長 劉智慧 政治作戰部副主任 謝芳慶 保防安全組副組長 黃名宏	企劃處處長 陳繼元 企劃處副處長 蔣雅倫 技術指導組組長 沈從正

本次出國在效益上，確已達到出國之目的。

案內資料已完成資料審查，未涉保密範圍。

一、建議跨單位出國案採審查彈性作業乙節，目前此類出國案件申報時程本院已要求以持會方式送審採彈性作法，惟對公差出國之國家、總天數及某時間內限制出國一次等限制規定，皆係依部頒規定辦理，非本院之權責。

二、本案請將資料上傳行政院研考會網站，並將報告裝訂五份紙本後送本處技術推廣組三份，一份送本處科資組及電子檔(自行上圖書館網站\工作報告資訊網，進e-doc系統上載留存)，另紙本一份送計品會研析。

所屬各子會 92.11.13 審查章

928424 (九二)泰淵所會字 413 號

企劃處 92.12.15 收文章

國外公差人員返國報告主官（管）審查意見表

本院執行經濟部科專計畫「寬頻無線通訊系統專案」研製之實體層(PhysicalLayer)已完成 384K 傳輸能力展示，經濟部要求以本院研製成果作為「第三代無線通訊系統軟體技術引進計畫」整合測試與驗證之平台。該技引計畫係由工研院電通所主導，本院及資策會配合參與合作。此次公差即為赴英國(用戶端)及印度(管控台及核心網路)確認整合驗證測試執行現況，並研討全系統整合展示方案之規劃及驗證等相關技術及介面。本次公差對於整合可能遭遇之問題經過深入探討後，已經將雙方之需求及後續執行方式完成溝通，並於返院後進行內部研討，對後續整合測試應有重要幫助。

本次參訪行程中除整合測試工作檢討外，另安排與當地重要研發廠商進行研討，如 PicoChip 公司之 processor 架構及 Ubinetics 之 TM-200，未來無線通訊發展方向及擁有之技術能量，對於本院及經濟部技術處科專計畫未來研究發展方向之規劃及執行有重要之參考價值。

所長 荊溪

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1630

依本院 85.11.25（85）蓮箐字 15378 號令，返國報告上呈時應附主官評審意見

報　　告　　資　　料　　頁			
1.報告編號： CSIPW-92C-H00002	2.出國類別： 考察	3.完成日期： 92 年 9 月 23 日	4.總頁數： 13
5.報告名稱：赴英、印訪廠執行無線通訊系統軟體技引案公差報告			
6.核准文號	人令文號	92 年 8 月 20 日 和程字第 0920006799 號	
	部令文號		
7.經　　費		新台幣：475,629 元	
8.出(返)國日期		92 年 9 月 2 日至 92 年 9 月 11 日	
9.公 差 地 點		英國、印度	
10.公 差 機 構		UbiNetics Ltd., Hughes Software Systems Ltd., picoChip Design Ltd., RadioScape Ltd.	
11.附　　記			

附件二

系統識別號

行政院及所屬各機關出國報告提要

出國報告名稱：赴英、印訪廠執行無線通訊系統軟體技引案公差報告

頁數 13 含附件：■是∧ 否

出國計畫主辦機關/聯絡人/電話

國防部中山科學研究院

出國人員姓名/服務機關/單位/職稱/電話

胡明德 國防部中山科學研究院 資訊通信研究所 聘用技正

翁國執 國防部中山科學研究院 資訊通信研究所 荐任技正

何賢奎 國防部中山科學研究院 電子系統研究所 少校技士

出國類別：■1 考察□2 進修□3 研究□4 實習□5 其他

出國期間：92.09.02 至 92.09.11 出國地區：英國、印度

報告日期：92.09.23

分類號/目

關鍵詞：

3GPP，UMTS，FDD，W-CDMA，UTRAN，ALL-IP，通訊協定，無線通訊，系統軟體，無線資源管理，基地台

內容摘要：（二百至三百字）

本院資訊通信研究所與電子系統研究所為執行經濟部無線通訊科專「第三代無線通訊系統軟體技術引進計畫」工作，派員赴英國及印度之 UbiNetic 及 Hughes Software Systems 等技引公司，確認基頻硬體與通訊協定軟體整合測試的執行現況，並研討全系統 End-to-End 整合測試驗證等的相關技術。本次公差訪英亦參訪了一無線通訊積體電路設計公司 picoChip，了解該公司基地台晶片的應用與效能測試的環境規劃，做為 3GPP R4/R5 基地台設計的參考。同時在倫敦赴 RadioScape 公司，了解該公司 UMTS FDD Layer-1 System Level Design Toolset 所能提供的功能與服務，以作為未來開發基地台無線資源管理演算法則驗證工具的參考。

本文電子檔已上傳至出國報告資訊網（http://report.gsn.gov.tw/work）

壹、 出國目的及緣由

目的：為執行由工研院所主導，中科院及資策會配合參與合作之經濟部無線通訊科專「第三代無線通訊系統軟體技術引進計畫」整合測試與驗證。

緣由：本院資訊通信研究所與電子系統研究所為執行經濟部無線通訊科專「第三代無線通訊系統軟體技術引進計畫」工作，派員赴英國及印度之 UbiNetic 公司及 Hughes Software Systems 公司，確認 Layer 2 以上通訊協定與基頻硬體整合測試執行現況，並研討全系統 End-to-End 整合展示方案之規劃、設計與驗證的相關技術。同時參訪英國 picoChip 公司，了解該公司基地台晶片的應用與效能測試的環境規劃，以做為 R4/R5 基地台設計的參考。並就近在倫敦赴 RadioScape 公司，了解該公司 UMTS FDD Layer-1 System Level Design Toolset 所能提供的功能與服務，以作為未來開發基地台無線資源管理演算法則驗證工具的參考。

貳、 公差心得

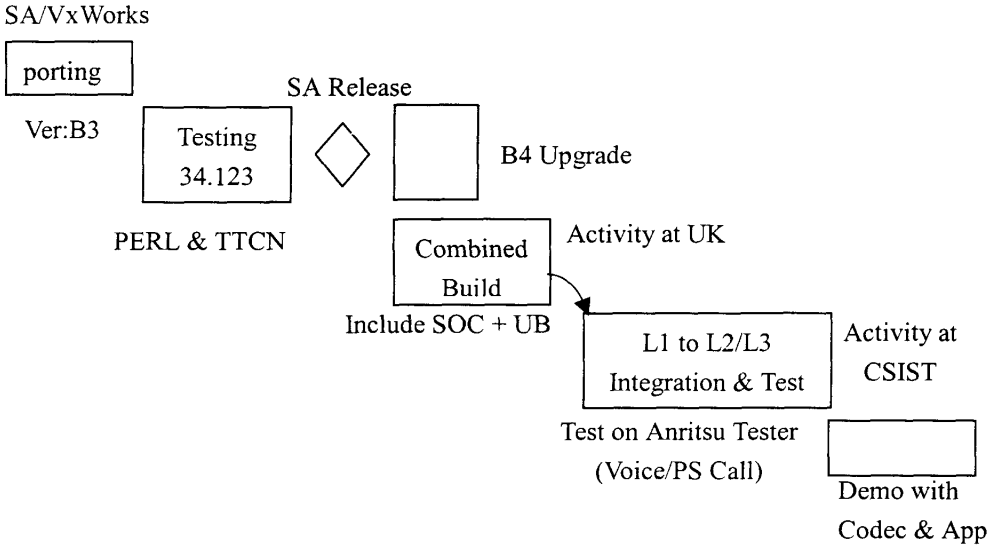
此次赴 UbiNetics、picoChip、RadioScape 及 Hughes Software System 等公司參訪並討論通訊系統軟體技術引進案及相關 3GPP 通訊協定軟體與基頻硬體整合測試，收穫頗為豐富，僅將參訪心得歸納於後，以作為本院後續執行 End-to-End 系統整合及研發 3GPP R4/R5 時之參考。

用戶台 L1 與 L2/L3 整合:

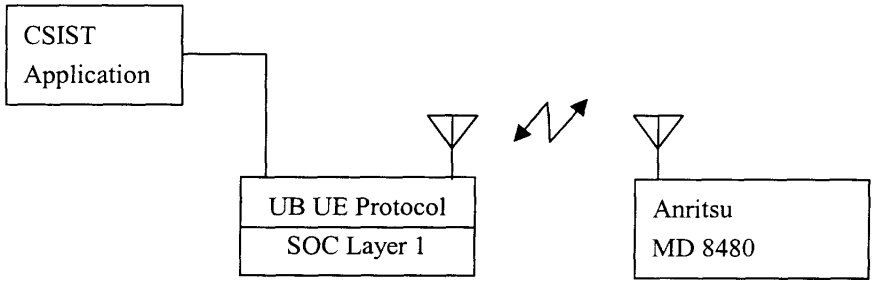
UbiNetics Limited 於 1999 年在英國劍橋附近成立，屬於 PA Consulting Group 的一支，專責研發新一代 2G、3G 無線數據通訊

技術，目前廣為世界研發團隊使用的 TM-100 Test Mobile (FPGA based)即為該公司所設計製造。UbiNetics 目前已使用手機 baseband processor 製造商 PrairieComm 的 Chips 設計新款的 Test Mobile TM-200 及 3G 手機模組 UM-100 與 UM-200。

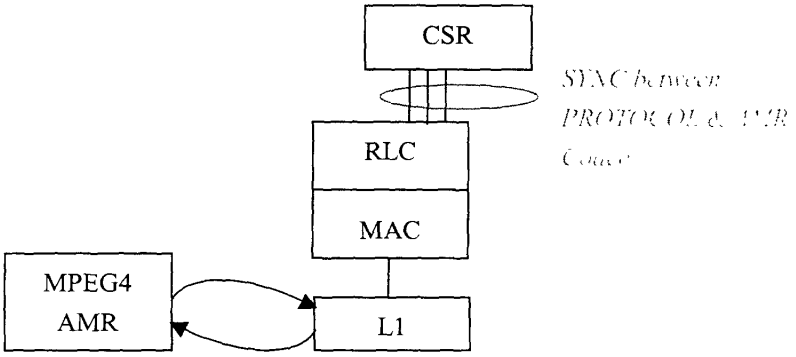
目前用戶台整合工作已在依計畫時程進行，規劃的工作方塊圖如下：



在 L1 與 L2/L3 整合後與 Anritsu Tester 測試的階段工作中，目前規劃的方法如下圖所示：



在 Demo 階段整合工作中，在整合應用層程式方面，初步共識為沿用目前 UbiNetics 使用的方法，即透過 TCP Socket 使用 AT-Command 來控制 NAS。在整合 Codec 方面，如 Data Stream 透過 RLC/MAC 往下送，則需解決 Protocol 與 AMR Codec 同步的問題，否則 Codec Data Stream 就只能直接往 L1 送，其與 3GPP 通訊協定 Layer 2 的相對關係圖如下所示：



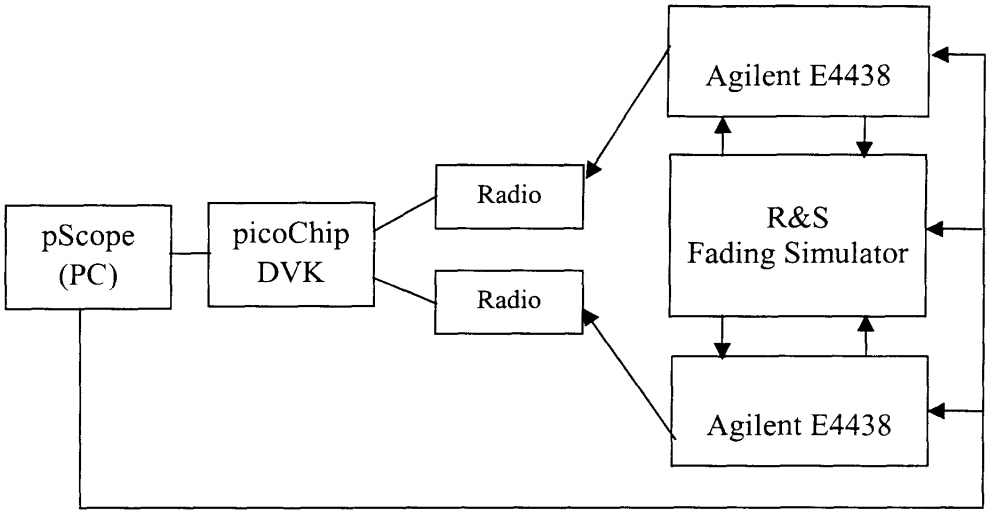
特別要注意：現階段對所有參與整合工作團隊的首要工作是軟硬、體版本控制，這包括變數、函數命名，介面資料結構，IPC 參數定義等。

R4/R5 基地台設計及性能測試：

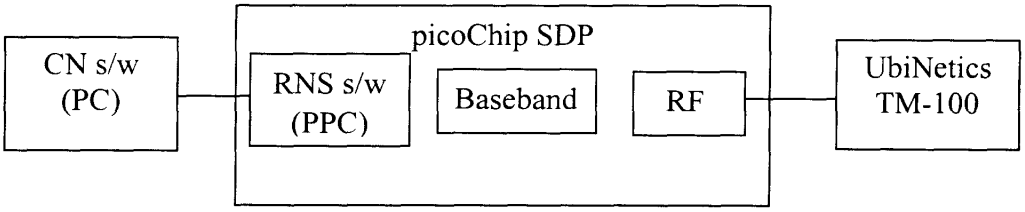
picoChip 公司為一高科技半導體積體電路(IC)設計公司，目前有 40 位富有經驗的工程師，該公司位於英國 Bath，為一具有 250 年歷史的古城鎮。picoChip 公司採用矩陣式的 processor 架構開發基地台 Chips，目前有 PC101 與 PC102 兩個版本。PC101 適用於實驗室的產品開發，PC102 為 IC 新製程，processor 數目增加，信號傳遞速度更快，適用商品化量產使用，而 IC 的製造晶圓廠正為台灣的 TSMC。

在基地台性能測試方面 picoChip 用兩台信號產生器模擬兩個天

線接收同一個用戶台 RF 信號源的兩個(即 diversity)信號，干擾信號可以直接從信號產生器的調節鈕即時由人工方式輸入基地台接收的 RF 信號，同時從測試控制電腦螢幕上，可以馬上監看 Turbo Decoder 受到即時干擾時的執行狀況，其測試方式如下圖：



另外，picoChip 用 UbiNetics TM-100 當做 UE，展示透過 picoChip 基地台與網路端進行 AMR CS-Service 的功能。CS-Voice Call Demo 的功能方塊圖如下：

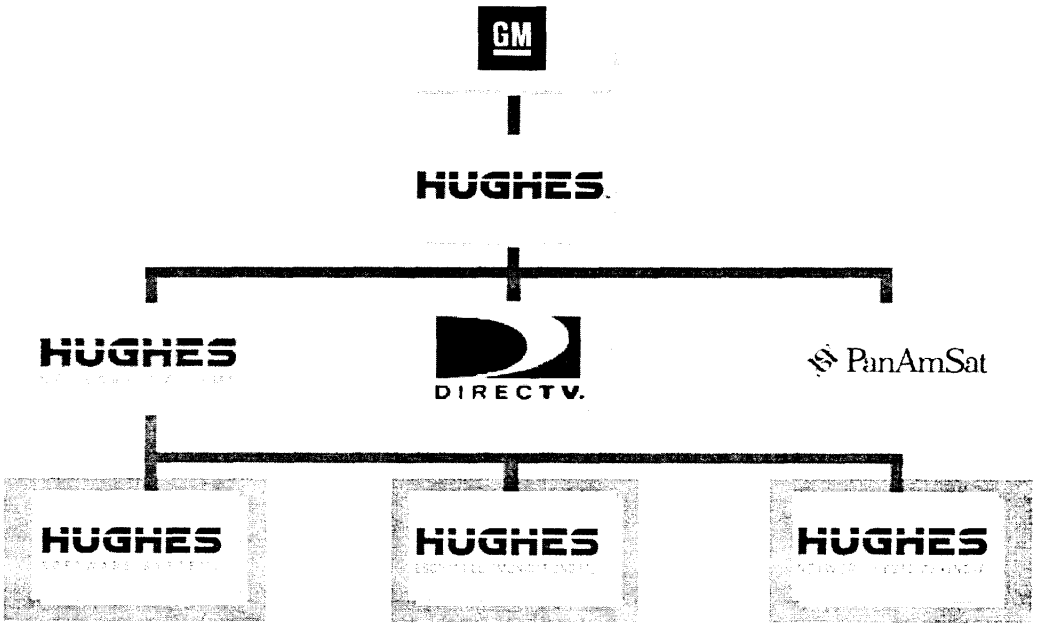


目前 picoChip 基地台尚未納入的重要功能為 Handover，根據該公司 roadmap 預計在 2004 年 Q2 才會有 Soft/Softer Handover 功能，所採用的架構為 6 cells + diversity，也就是在基地台會用到 12 根接

收天線。而 R5 需求的 HSDPA (14M bps)功能，預計在 2004 年 Q1 就會提供。

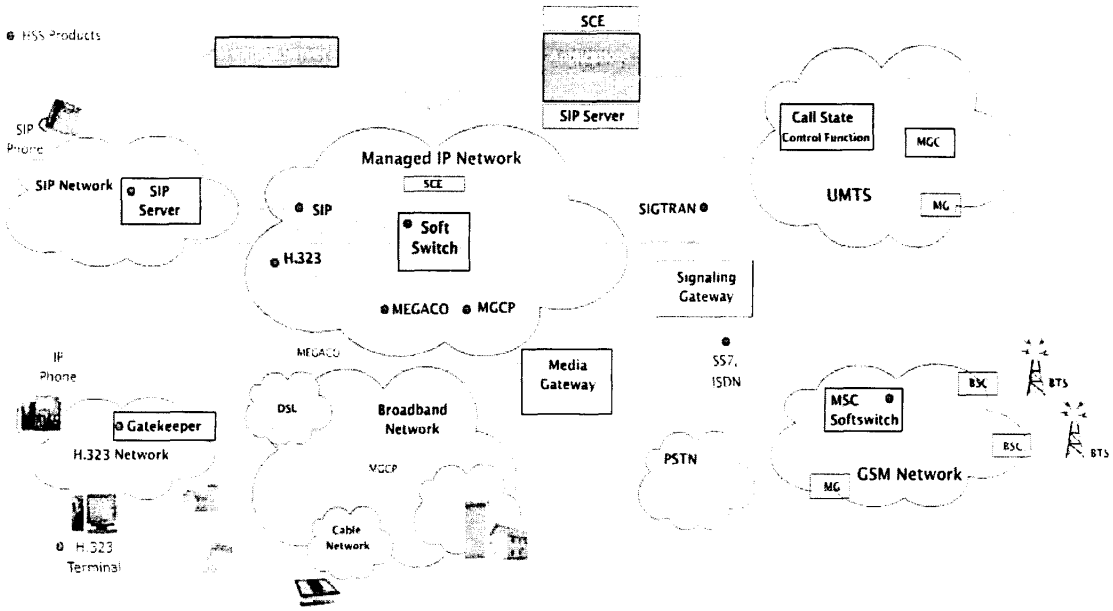
通訊協定開發、測試及 End-to-End 整合：

Hughes Software Systems Limited (HSS)於 1992 年由 Hughes Network Systems (HNS)在印度新德里成立，HSS 公司的族系關係如下圖：

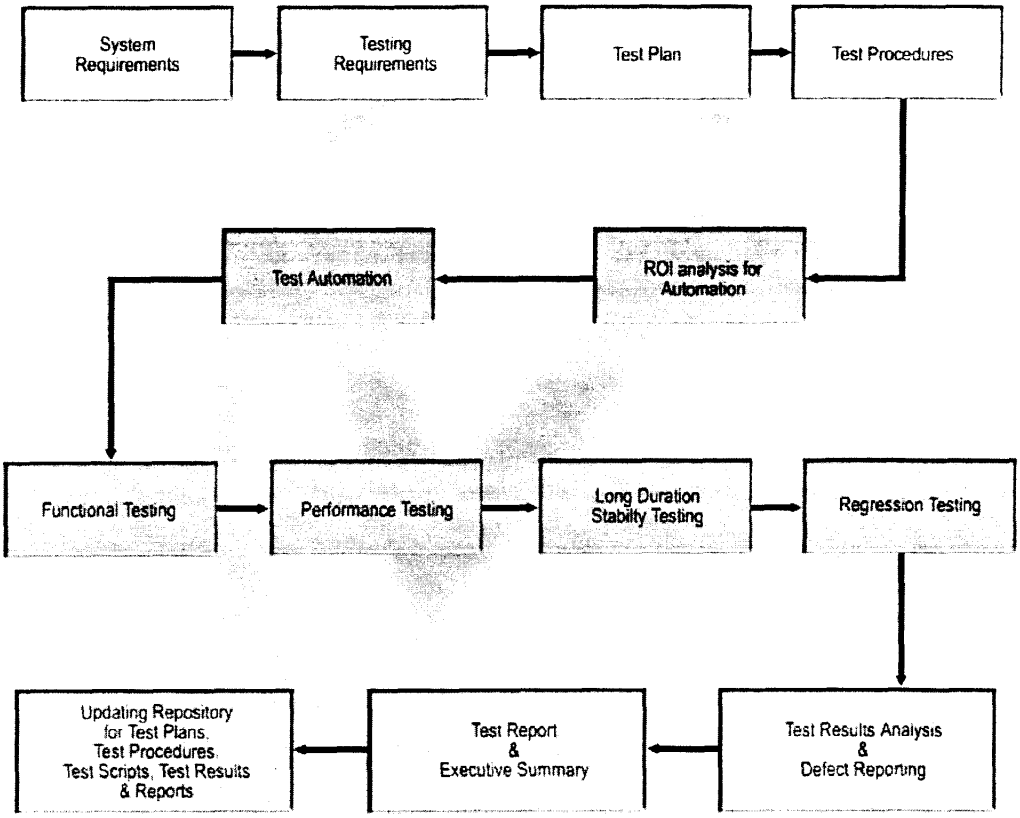


HSS 於 1995 年因應公司成長，搬遷到靠近新德里的 Gurgaon，該中心主要在開發通訊協定相關軟體及代工服務，1998 年 HSS 針對 Internet Protocol 及通訊應用程式的需求，在 Bangalore 另外成立軟體發展中心，該中心因應網際網路需求，也提供 Network/ Service provider 像 I-business 及 E-commerce 的相關產品及設計服務。對於

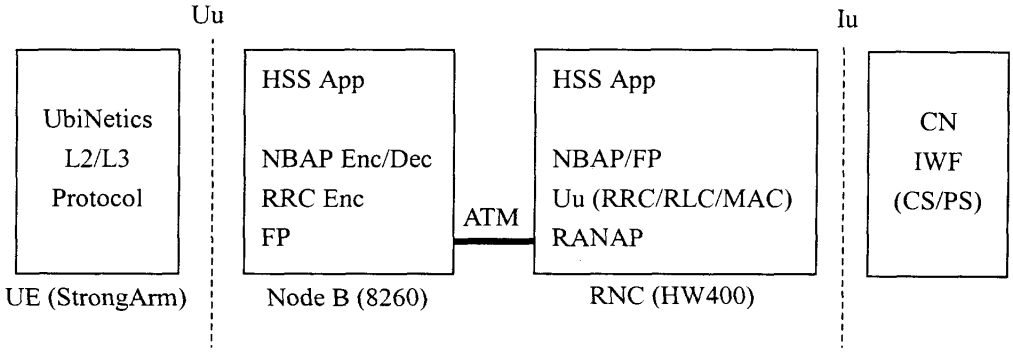
未來 3GPP R4/R5 走向 ALL-IP 趨勢的網路世界，HSS 提出的解決方案如下圖：



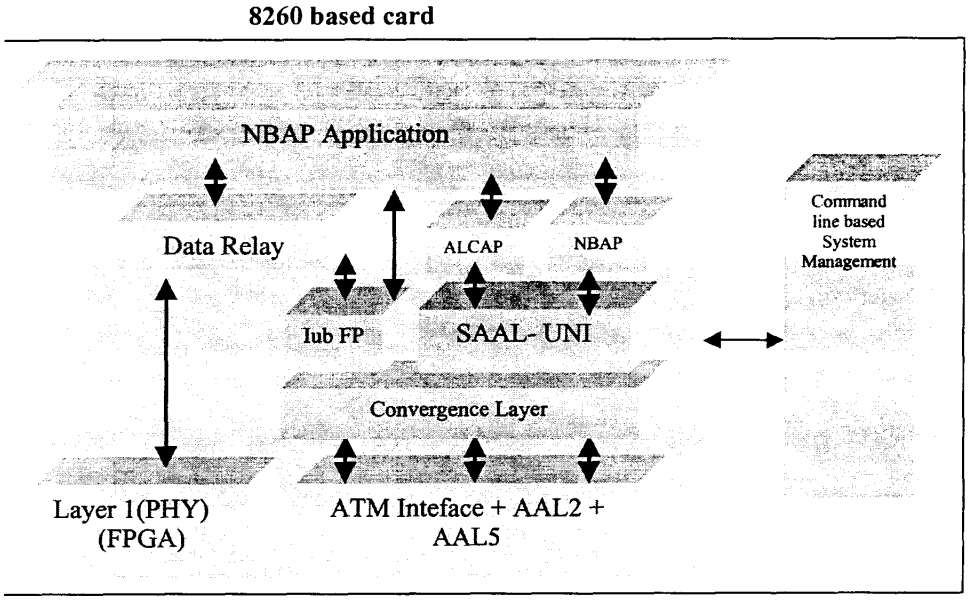
HSS 位於 Gurgaon 及 Bangalore 的軟體發展中心，同時於 2000 年成為 Software Engineering Institute's Capability Maturity Model (SEI-CMM) Level 4 的軟體公司，更於今年(2003)同時成為世界上少數擁有 SEI-CMM Level 5 殊榮的軟體公司，經由認識其研發及管理制度的建立，工程人員歷練及教育訓練的規劃，以及計畫評估、執行、管理和品管、測試的落實。甚至針對 Support Team 使用 6-sigma 的考評來確保對客戶服務的品質，由此可以理解為什麼 HSS 可以成為印度排名第一的通訊軟體公司，又為什麼可以將「軟體」當作一種「產品」來生產。HSS 公司 QT 部門的 Testing Lifecycle 流程圖如下：



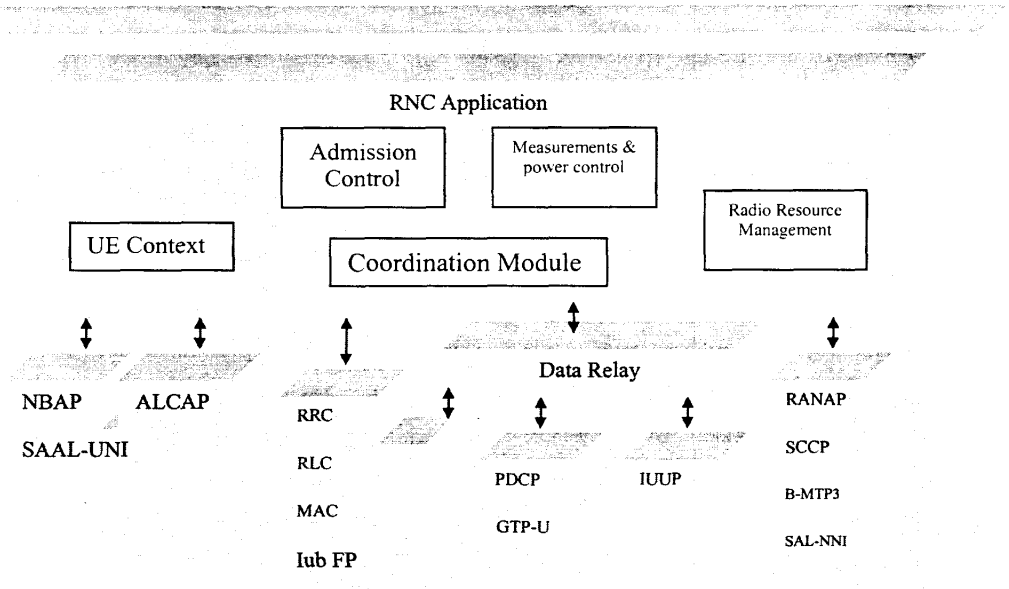
全系統 End-to-End 全系統整合測試需求部份，在和 HSS 工程師經過兩次討論交換意見後，訂出基本規格及介面，同時也讓我們清楚認知在 Node B 及 RNC 中尚需補強的部份。全系統各個 Network Node 的功能及介面如下：



以 8260 Main Controller Board 開發的 Node B，其細部通訊協定與應用程式架構如下圖：



而以 HW400 cPCI peripheral CPU board 開發的 RNC，其通訊協定與應用程式架構如下圖：



參、 效益分析

由於 WB-CDMA 之技術層次及複雜度很高，第三代無線通訊系統軟體技術引進案自簽約迄今已近兩年，直至近日才陸續完成軟體 ATP 測試，正進行與硬體的整合工作。本院負責完成基頻硬體研發、軟體植入(porting)與系統整合，其中尚有諸多技術待突破，困難度甚高。而本院整合的經驗與技術的建立，正可滿足國內業界踏入 3G 市場的需求。此次公差效益歸納如下：

1. 實地參訪技術引進案合作廠商 UbiNetics 公司，了解其 TM-100 (FPGA)、 TM-200 (Chip)、UM-100 (Single Mode) Module, UM-200 (Dual Mode) Module 一系列 3G 產品的研發、測試現況；澄清整合驗證中 Combined Build 及 Integration Test 兩階段相關工作的界定及執行方式；並研討用戶台系統功能展示的細部規格及相關展示環境設計，確保本案得以如期順利完成全功能展示。
2. 實地在 picoChip 公司應用矩陣式的 processor 架構的 Chip 所開發的 R4 基地台上，操作基地台接收/處理 diversity 信號的性能測試，並在測試 AMR 語音服務的平台直接撥打電話，顯示該公司通訊軟體技術也具有相當的成熟度。特別是該公司的 Chip 具多樣應用性，也非常適用於開發新一代的 SDR (Soft Define Radio) 系統。透過實地參訪瞭解其技術能力與經驗，並參考本院科專計畫之需求，對未來開發 R4/R5 基地台之規畫及執行有極大之助益。
3. 透過與 3G UTRAN/CN 技引案合作廠商 Hughes Software Systems 公司進行技術研討，讓我們瞭解建立 3GPP W-CDMA 無線通信協定開發及測試能量所需之各項作為，帶回的相關資料並可作為本院建立此能量時所需之基本參考依據。另外，和 HSS 工程師討論全系統 End-to-End Integration Test 基本需求規

格的過程中，也讓我們清楚認知目前本院系統應用程式所欠缺的功能。

肆、 國外工作日程表

09/02-09/02（星期二）：啟程、自桃園至英國倫敦。

09/03（星期三）

本日主要是與 UbiNetics 公司執行 Integration 計畫的核心成員(Raj, Kim, Fabio)規劃有關 Combined Build 及 Integration Test 的工作，並研討相關工作現況及條例目前尚待澄清的事項。接著討論設計應用程式時與 NAS 間經由 TCP Socket 使用 AT-Command 的相關事宜。之後由 Raj 帶領參觀其 TM-100 及 TM-200 的研發及測試實驗室；其間並展示正在開發測試的 UM-100 Module (FDD Single Mode)，在一張名片大小下整入 3G Baseband 及 RF 讓人印象深刻。

09/04（星期四）

因應國內技轉廠商對手機 Chip 的需求，與 UbiNetics 公司討論其合作的手機 baseband processor 製造商 PrairieComm 目前的合作狀況，並瞭解國外手機商使用該 Chip 的情形。之後與 UbiNetics 公司執行 Integration 計畫的核心成員討論有關年底 Demo Scenario Design 的幾個可行的組合，將提供丁主持人參考。另外，由於現階段執行 Combined Build 時，因責任歸屬不明造成許多事項無法澄清，UbiNetics 希望界定整合測試執行時三方合作的責任歸屬；因本案執行狀況會影響工研院付款時程，因此晚上立即將這兩日的討論結果用 E-mail 向國內回報。

09/05（星期五）

首先由翁博士簡報本院現有之基地台設計架構及測試現況，之後由 picoChip 介紹該公司產品之設計架構、功能與應用。並展示該公司採用自行開發的矩陣式 processor 架構 IC。目前 IC 有兩個版本 PC101 與 PC102。其中 PC102 為新 IC 製程，processor 數目增加，因此信號傳遞速度更快，非常適用於開發 SDR (Soft Define Radio)，據稱已有美國承商以其開發 SDR 應用。

09/06（星期六）

CCL/ITRI 成員因故未能成行，因此臨出國前聯繫位於倫敦市的 RadioScape 公司進行短暫參訪，因此僅就歐洲當熱門的 DAB(數位廣播)系統的技術與運作現況及 UMTS FDD Layer-1 System Level Design Toolset 在開發相關演算法則的驗證與模擬應用上進行討論。之後參觀大英博物館、白金漢宮及夜遊海德公園。

09/07-09/07（星期日）

早上自英國倫敦搭機到印度新德里，晚上與資策會施先生及楊小姐在 Radisson Hotel 會面，協商未來三日行程及雙方任務需求。

09/08（星期一）Gurgaon Division:

在 HSS 完成 3GPP 研發現況介紹後，由胡博士說明本院目前 W-CDMA UE/NodeB/RNC/CN-IWF 的研發、整合與測試現況。之後，由執行本技引案的 QT 部門介紹測試團隊的形成及測試計畫與執行步驟的設計過程，然後到 QT 部門的測試現場並以 SUN Solaris 實機操作 UE NAS 層的幾個測試程序。接著，軟體設計團隊在同一實驗室的 cPCI/VxWorks 平台上，使用 Stream Server 展示 End-to-End Data Flow 的分封數據傳輸服務。

09/09（星期二）Gurgaon Division:

由胡博士就本院現有架構及未來測試工作向 HSS 工程人員說明，並協同翁博士訂出 End-to-End Integration Task 的基本規格及需求，HSS 並確認 9/22 將可依此需求提出 Proposal。之後由 UE Project Team 用該計畫當例子，說明該公司 Project Management；Quality Management 等作為的執行、評估及管理工具。

09/10（星期三）Bangalore Division:

因用戶台 NAS 層與應用層的介面規格與控制機制問題已在英國 UbiNetics 充分討論並獲得解決，因此與資策會協商與 HSS Bangalore Division 研討 3GPP R5 ALL-IP Core Network 端有關 SIP Server 等設計現況及功能展示。

09/11-09/11（星期四）凌晨三點搭機返國。自印度新德里到桃園。

伍、 社交活動

1. 9 月 3 日（星期三）

中午與 UbiNetics 的主要工程師一同午餐，互相分享工作心得及歐洲 Wireless Communication 產業現況，期間並談及英國各公司之人事部門主管經常聚會建立人事情報管道，因此當某公司需作人員調整時，人事部門主管便可以馬上推薦到其他的公司及適才的部門繼續工作，值得我們借鏡。

2. 9 月 9 日（星期二）

因 HSS 工程師 Sanjiv 剛在台灣完成兩週的 On-Site Support 工

作，HSS 公司為感謝本院及資策會對 Sanjiv 在台期間的協助，HSS 的計畫管理及工程部門成員邀請**資策會**與本院同仁在住宿旅館的 Kabab Factory 印度餐廳晚餐。

陸、 建議事項

本計畫為執行由工研院所主導，中科院及資策會配合參與合作之經濟部無線通訊科專「第三代無線通訊系統軟體技術引進計畫」整合測試與驗證，需與工研院電通所及資策會網通實驗室配合進行經濟部軟體技術引進工作。但依國防部規定，本院員工國外公差必須於 45 天前提報出國審查作業，但本計畫跨三個組織、四個國家，且技術門檻高，許多事件無法在 45 天前預知，更不能要求國內、外各單位，大家一切配合本院的出國審查作業。因此建議，本院執行類似有跨組織、國家的計畫時，可以比照前**航空工業發展中心**執行**安翔計畫**時的**彈性出國令**作法，即出國命令中：

1. 限制公差國家。
2. 限制公差總日數。
3. 限制某時間範圍內，准予進出國境一次。

以使執行類似跨組織、國家的技術引進或國際合作計畫時能達最大成效。

附 件

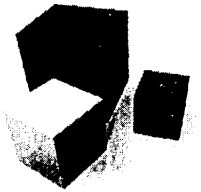
1. UbiNetics Presentation。
2. picoChip Presentation。
3. RadioScape Presentation。
4. Hughes Software System Presentation。

附件一

UbiNetics™

CSIST UbiNetics

3rd September 2003



Agenda

- Agree on key milestones for integration work - Ubi
- Key dependencies on third parties - Ubi
- Discuss and understand the risks associated with integration and how to mitigate them - ALL
- Specification of Final Demonstration - CSIST
- Clarification of scope of work and roles/responsibilities - ALL

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Dependencies

Party	Dependency	Status
SOC	L1 SW Header Files	√
SOC	L1 SW Executable	√
SOC	L1 SW Src Files	√
SOC	Adequate Documentation	X
SOC	Makefiles (CFLAGS + Link FLAGS)	X
SOC	Updated L1 SW to avoid naming conflict	X
CSIST	Demo Spec	X

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Risks and Issues

- Naming Clash - CSIST to discuss with SOC to rename functions and variables or to find another solution
- L1 API Version – Ubi to send CSIST/SOC interface spec and .asn file for CSIST to regenerate the socapi.c/h for the layer 1 interface
- L1 Integration bugs – CSIST will organise overall integration and if there are L2/3 bugs, these will be passed to UbiNetics to fix; if there are L1 bugs, these will be passed to SOC to fix
- SOC new software changes interface – CSIST to confirm with SOC
- SOC Dependencies – CSIST to help Ubi to get this information as soon as possible
- SOC Communication – Use Dr Tien and Dr Ting to ensure fast response from SOC
- Demo Requirements – Discuss some options for demo
- Loopback Mode – loopback mode required to test L1

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Roles & Responsibilities (to be discussed with Dr Ting)

Activity	Ubi Role	SOC Role	CSIST Role
VxWorks/SA Porting	Responsible	-	-
VxWorks/SA Testing (34.123)	Responsible	-	-
L1 and L2/3 Combine Build	Responsible	Provide Dependencies	Manage SOC
L1 to L2/3 Integration	L2/3 Support	L1 Support	Responsible
Codec/Demo Integration	L2/3 Support	L1 & Codec Integration	Responsible

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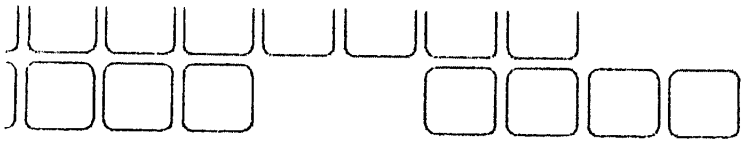
附件二



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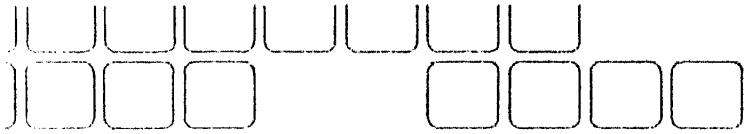
Introduction to picoChip



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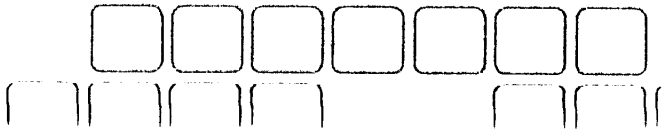
Company Overview

- The picoChip team today
  - **Wireless / UMTS Systems Eng. 11**
  - **Protocol Stack & API 2**
  - **Silicon Design 8**
  - **Tools 5**
  - **RF Development 2**
  - **Operations / Hardware Design 5**
  - **Marketing / Business 4**
  - **Other 5**

- Diverse, world class engineering team of silicon design, tools and systems expertise
- Currently expanding team WW to support considerable customer interest



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Experienced Senior Management

Key Executives:

- Dr. Rodger Sykes, CEO: TI, Philips, LogicVision (inc IPO). 22 years in IC industry.
- **Peter Claydon, COO & Founder: Marconi, Brooktree, Pioneer, Oak, Conexant. 18 years.**
- Dr. Doug Pulley, CTO & Founder: Vodafone, Lucent, Oak, Conexant. 13 years wireless systems
- **Steve Barraclough, VP Bus Development**: TI, ST, Brooktree, Lucent, Anadigics. 18 years.
- Rupert Baines, VP Marketing: Analog Devices, Arthur D Little, Atlantic Telecom, Pond. 16 years.
- Will Robbins, Design Director & Founder: ST, Brooktree, Oak, Conexant. 15 years, 29 patents.
- Mike Davison, Director Operations: Marconi, Brooktree, Pioneer, Oak, Conexant. 20 years.

Board:

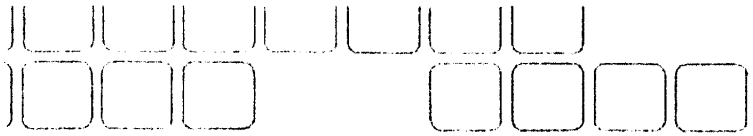
122 years total experience

- **Richard Irving**: Founding Partner, Pond Ventures. Successful investor in Microcosm
- **Graham O'Keeffe**: Atlas Venture.
- **Jamie Urquhart**: Founding member & board of ARM

Technical Advisory Board:

- **Professor David May**: Bristol University, parallel processing expert –
- **Dr. Simon Saunders**: Surrey University, Director Cellular Design Services Ltd.

Total team 42, based in Bath, UK.



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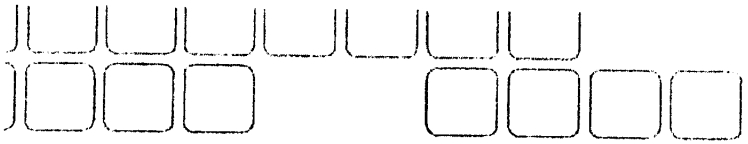
Wireless System Product Portfolio and Technology



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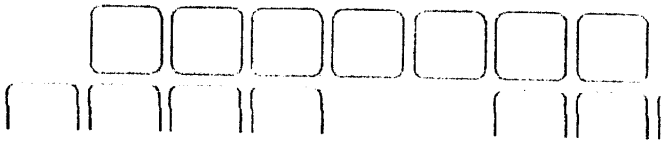
Agenda

- picoChip Value Proposition
- Product Portfolio & Technology Overview
- Benefits
  - Accelerated Time-to-Market
  - Scalability, Flexibility, Multi-Standard
  - Low Cost, High Performance Component Roadmap
- Summary

INTERNAL

INTERNAL



picoChip **is a communications systems company, dedicated to supplying flexible, scaleable, integrated circuit based solutions for next generation wireless and wireline applications**

Platform Product Strategy

- Wireless Communications Processors
  - Integrated tool Suite
  - Code libraries
  - Evaluation Kits
  - Development Kits
- Ultra Broadband Radio solutions
- Reference designs
- Intellectual Property

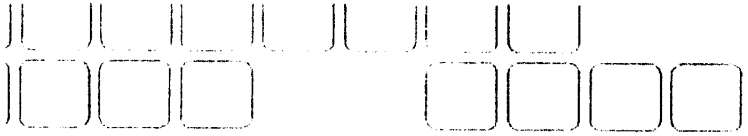
Market Focus

1. WCDMA Node B Infrastructure
2. TD-SCDMA/CDMA2000
3. DSL / VDSL
4. Broadband Wireless
5. WLAN smart access
6. Wireless Terminals
7. Data Encryption / Decryption

UMTS Node B Value Proposition

picoChip's technology and Systems Expertise delivers

- **Fastest time-to-market, lowest development costs**
  - Complete, integrated development platform
  - UMTS Compliant, 'Carrier Class' Software Libraries
  - World Class Systems and Applications support
- **Field configurable / upgradeable Node B systems**
  - Standards evolution and update
  - System optimisation
- **Low cost, high performance component roadmap**
  - Aligns to volume manufacture in 2004/5



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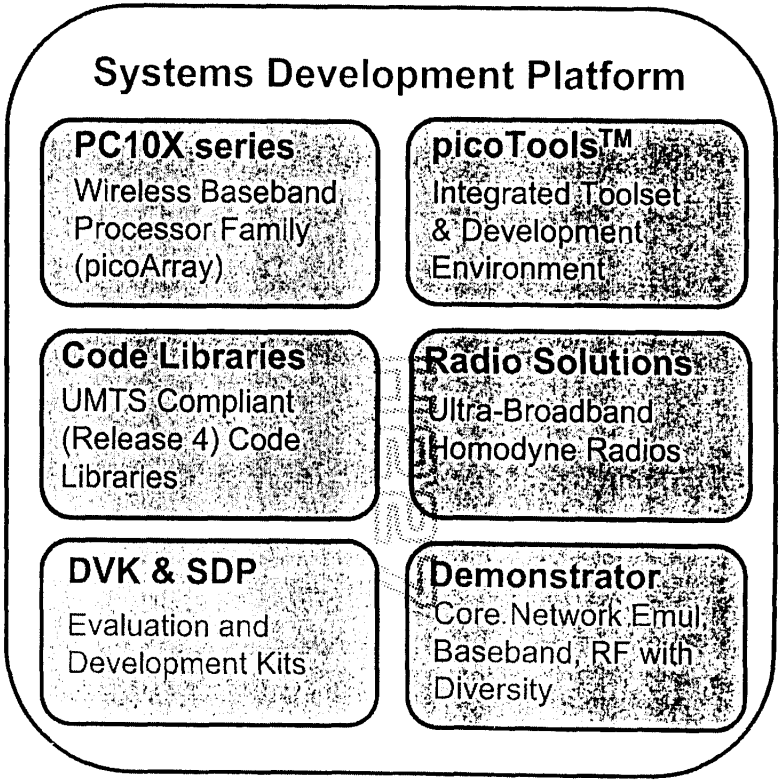
Product Portfolio and Technology Overview

picoChip Product Portfolio

Scaleable Technology Platform for High Capacity 3G Basestations

- **UMTS Compliant (Release 4) code Libraries**
  - Software Reference Designs
- **Wireless Communications Processors based on the proprietary picoArray**
  - Tools
  - Evaluation Boards & Development Kits
- **UMTS Radio Reference designs**
  - Small, low cost, high performance broadband radio's
- **Intellectual Property**
  - Algorithms



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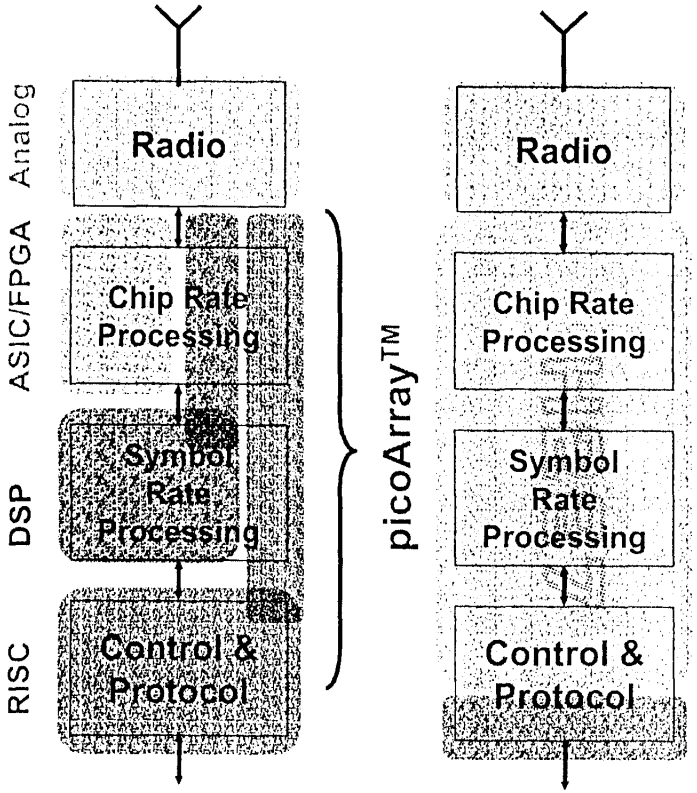
Wireless Communications Processors

Wireless Communication Processors: Solution Space



Fully Integrated Components and Tools

- Software SOC - Entirely Software (C & ASM) programmable baseband.
- Ability to aid customer changeover and quickly integrate existing algorithms
- Very High degree of flexibility
- Everything that an ASIC and DSP can do

Single environment

- No software/hardware partitioning
- No co-design & simulation
- Ease of programming, Ease of change
- "Instant" prototyping

Simplified, Deterministic Verification

- No Scheduling or Arbitration
- High confidence solution, high reliability

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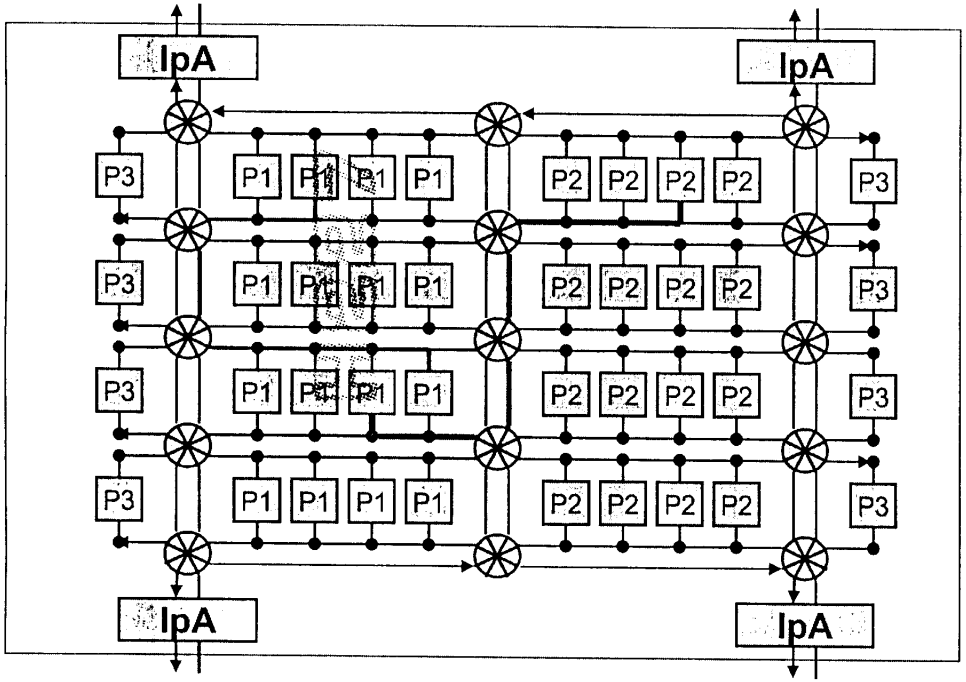
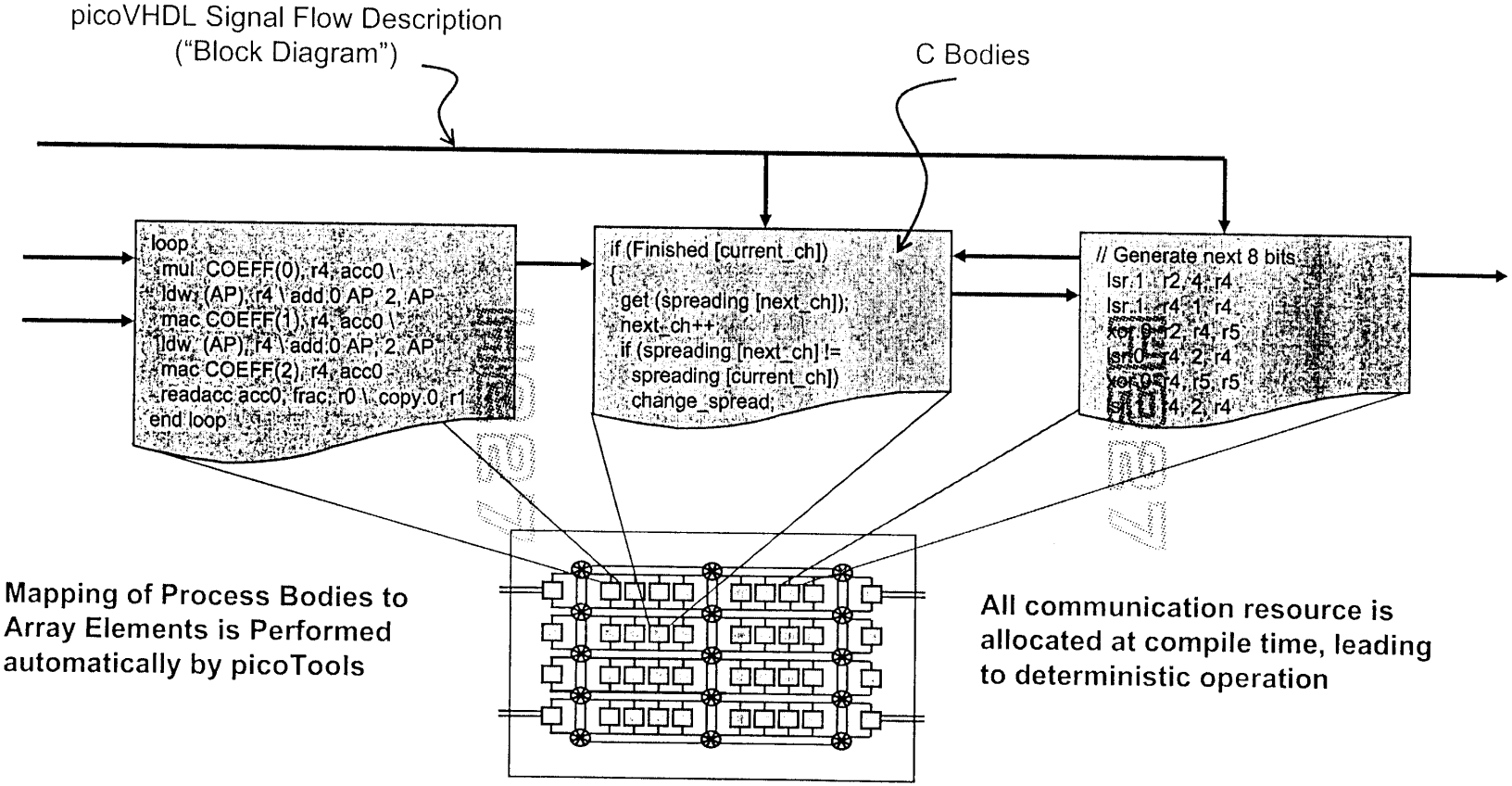
The picoArray concept



- Massively parallel array of "Coarsely Grained" RISC processors (Array elements)
- TDM inter-processor communication scheme
- Four types of Array elements, optimised for either DSP or control oriented tasks
- Granularity optimised for all wireless algorithms
- Processing elements are programmed in C or Assembler

Px Array Processing Element Switch Matrix

Array Configuration & Programming



Mapping of Process Bodies to Array Elements is Performed automatically by picoTools

All communication resource is allocated at compile time, leading to deterministic operation

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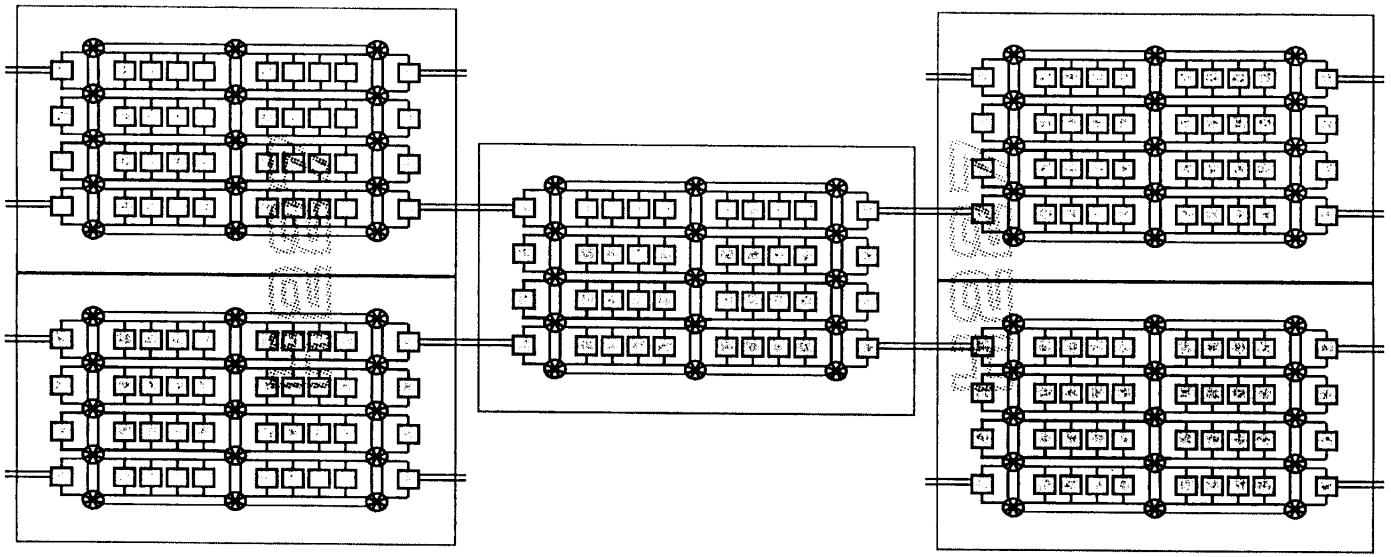
Interconnected picoArrays



- Inter-processor communication scheme scales across multiple devices
- Unlimited number of devices can be interconnected

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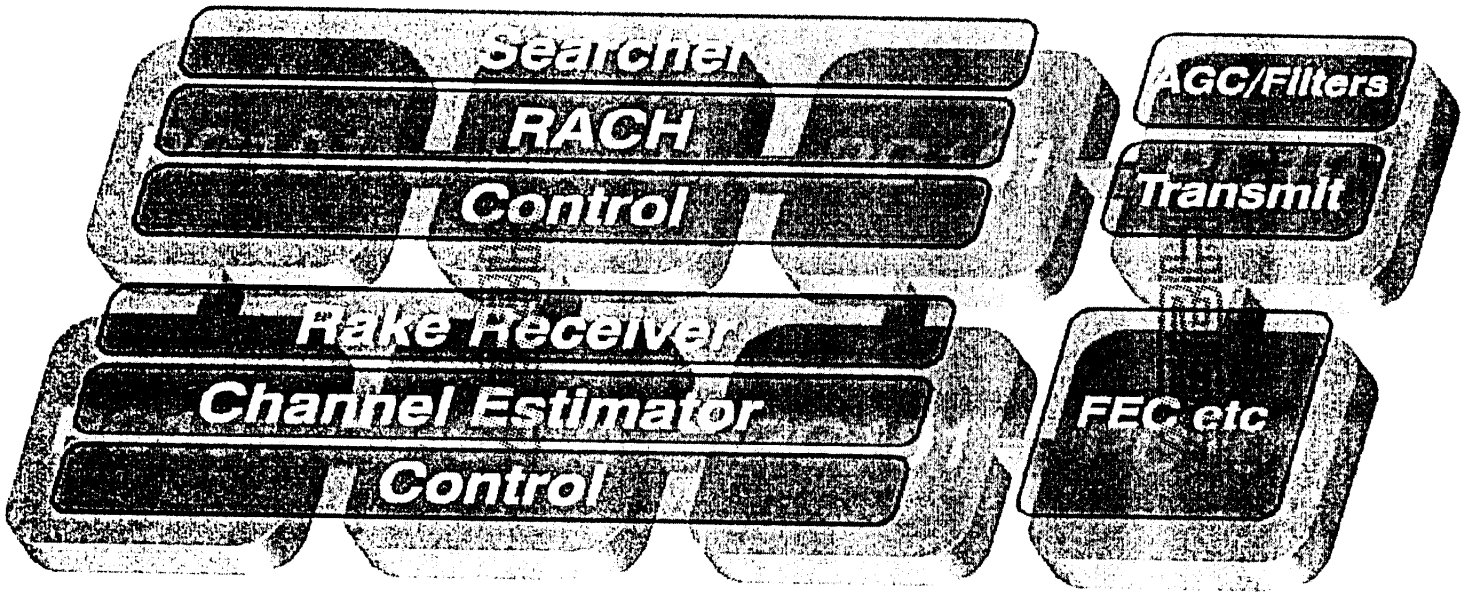
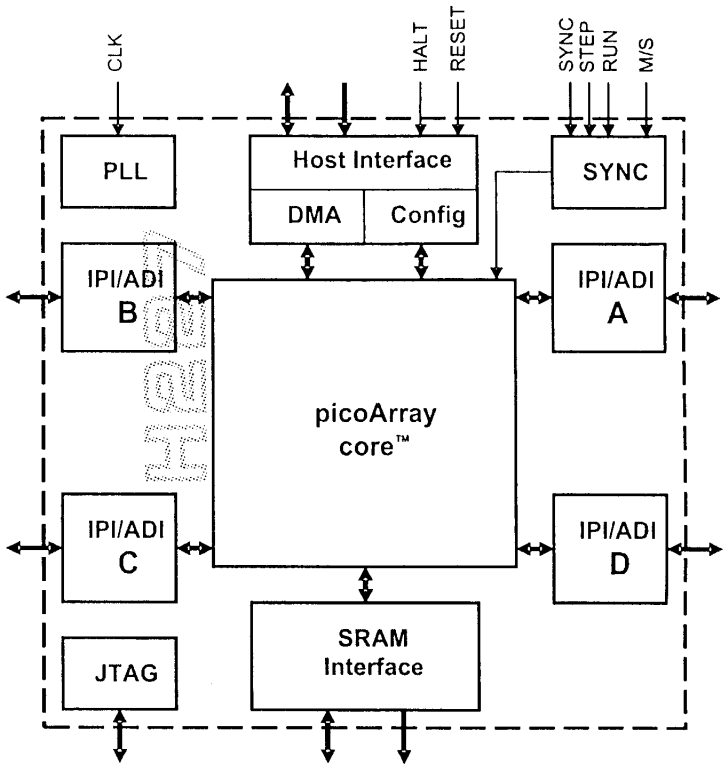
Example 64 Channel UMTS Design Partition



PC101 Device Overview

Specification	Parameter	Unit
LIW RISC processors	430	per device
Processor clocks	160	MHz
Processing capacity	>137.6	GIPS
Internal IPC speed	5.12	Gbit/sec
External SRAM	8	MBytes
SRAM access speed	1.28 / 2.56	Gbit/sec
DMA channels	4	per device
DMA max. speed	2.24	Gbit/sec
Inter-device channels	4	per device
inter-device speed	1.28 / 2.56	Gbit/sec
16 bit I/O channels	8	per device
I/O speed/channel	1.12	Gbit/sec



~20x performance of TMS320C6415/6 and ADI TigerSharc processors!!

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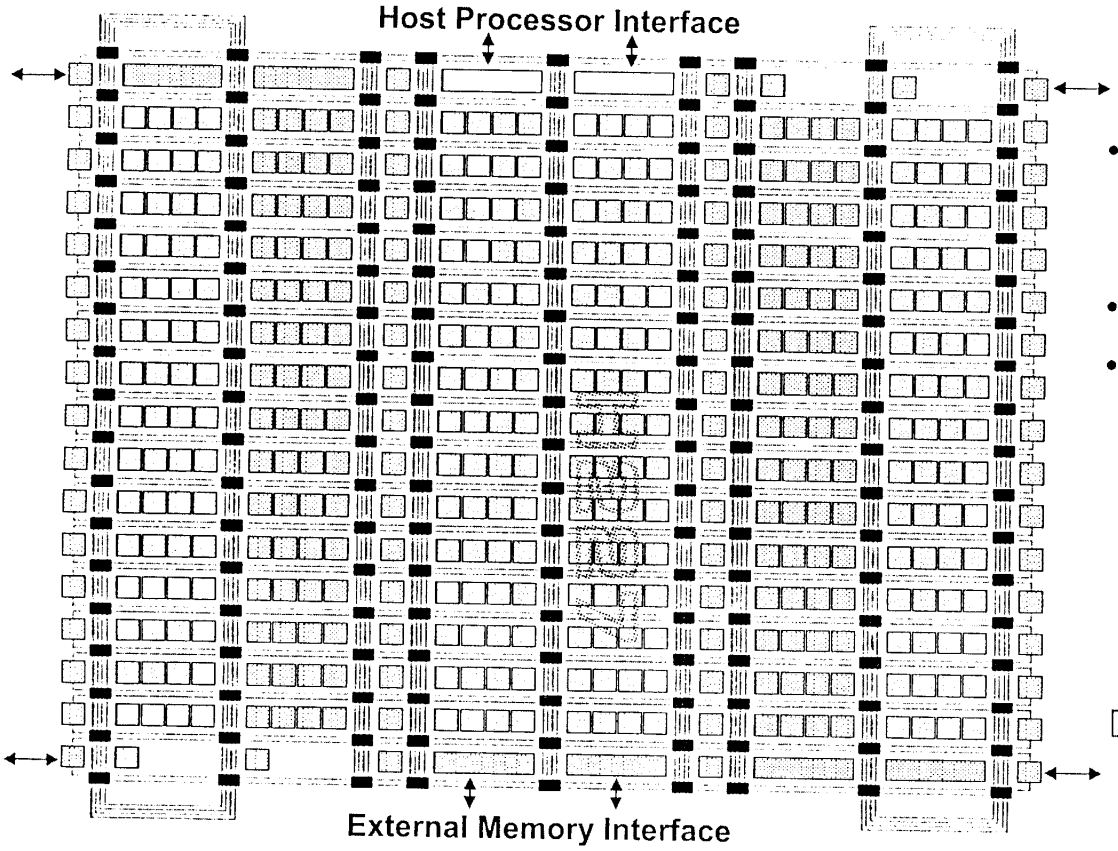

The PC101 picoArray™

- An array of processing elements, (AEs) tuned for wireless applications
- PC101 has 430 AE's
- Integrated peripherals; sramIF, ADI/IpA, procIF

PC101 AE Count

- 240 STAN
- 120 MAC
- 68 MEM
- 2 CTRL
- Switch Matrix

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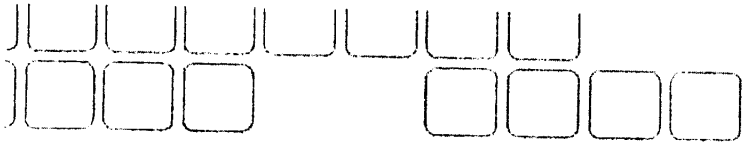
Wireless Communications Processor Roadmap

Device	Description	Sample Availability
PC101	• 1st Generation • 430 AE's , 160MHz, 130nm CMOS(TSMC) • General purpose OFDM	**Now** (First Samples Q4 2002)
PC102	• 430 AE's, 160MHz, 130nm CMOS • Area and Power Optimised • RACH, CPCH & FEC Acceleration • Enhanced CTRL AE's (protocol termination) • 4-5x Processing density of PC101 • **Structure & Code port from PC101**	Q4 2003
PC103	• 600 AE's, 320MHz, 90nm CMOS • Further RAKE Acceleration • 4X Processing Density of PC102 • **Structure & Code port from PC102**	Q1 2005



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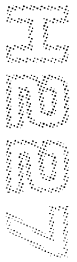
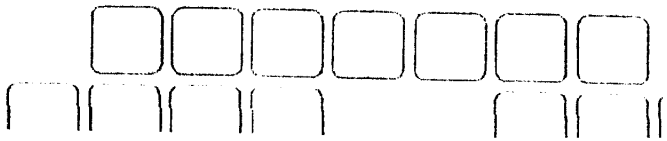
Code Libraries





UMTS FDD Node B Code Library

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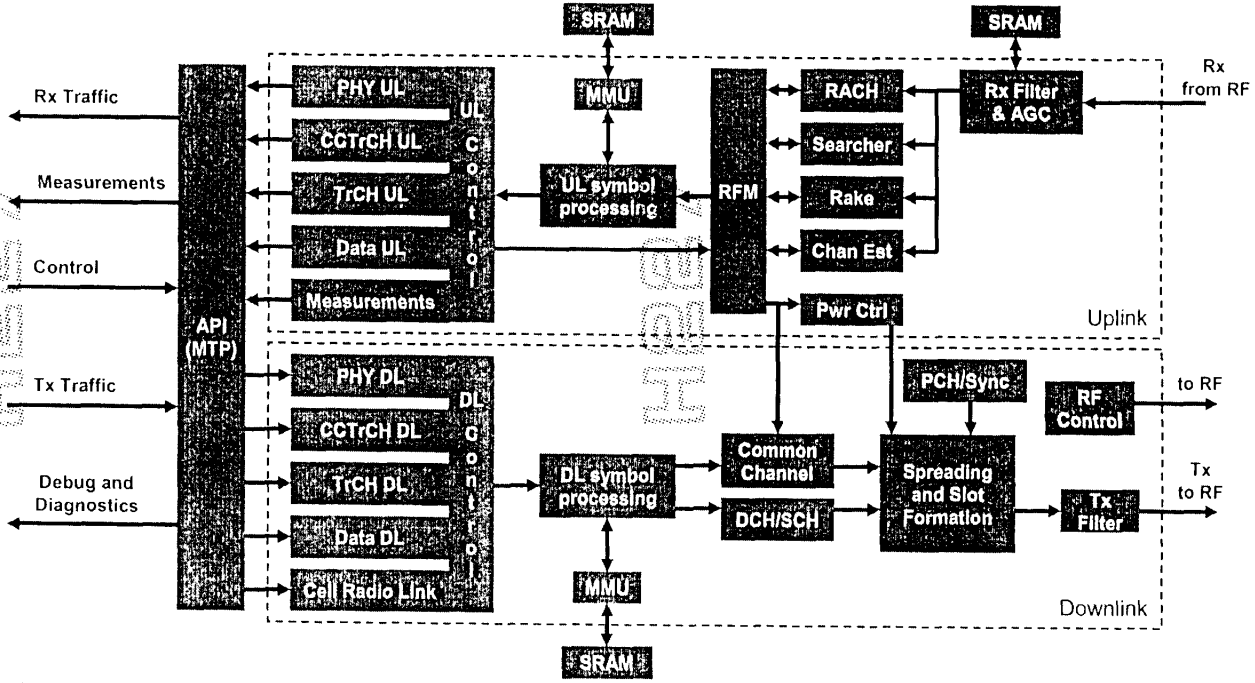
Downlink
- Tx TrCH TTI Processing
- Tx CRC
- Channel Encoder
- First Level Interleaver
- Rate Matching
- TFCI Encoder
- CCTrCH Handling
- Tx PhysCH Processing
- Second Level Interleaver
- Spread & Gain
- Tx Filter

Uplink
- Rx Filter
- Rx Gain
- RACH/CPCH PD
- Searcher
- Rake Receiver
- Rake Finger Manager
- RACH/CPCH PD – RFM IF
- Searcher - RFM IF
- Rake/ChanEst-RFM IF
- Tx-RFM IF
- Channel Estimator
- TFCI Decoder
- Rx PhysCH Processing
- 2nd level De-Interleaver
- Rx TrCH Frame Processing
- Reverse Rate Matching

- 1st level De-Interleaver
- Rx TrCH TTI Processing
- ***Viterbi Decoder***
- Turbo Decoder
- Rx CRC
- NBAP Measurements



Utilities
- Memory Management Unit (MMU)
- SRAM Fetch
- Resource Management
- Control Processor Interface
- Downlink Processor Interface
- Uplink Processor Interface
- Common Entity Managers
- Downlink Entity Managers
- Uplink Entity Managers

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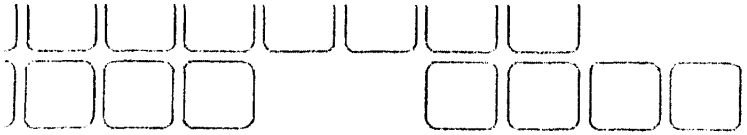

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Code Library Development Milestones

Library	Notes	Schedule
UMTS FDD Release 4	Macrocell & Microcell optimisation	July '03
TD-SCDMA	Joint Detector Demonstration	September '03
UMTS FDD Release 4	Picocell optimisation	September' 03
NBAP	Termination Protocol Demonstration	November '03
CDMA2000	Demonstration	December '03
UMTS FDD Release 5	Macrocell & Microcell	July 04

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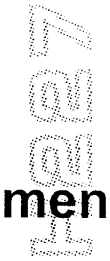
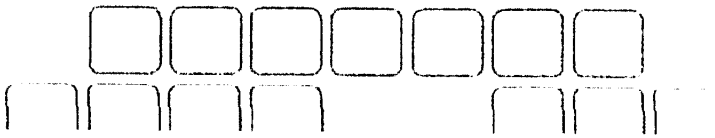
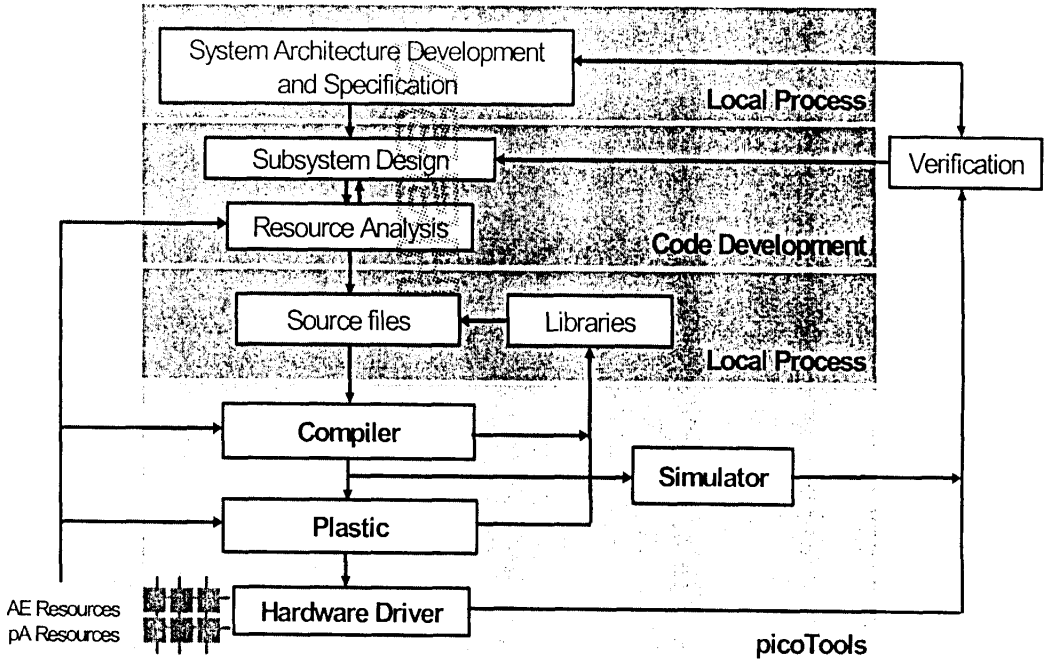


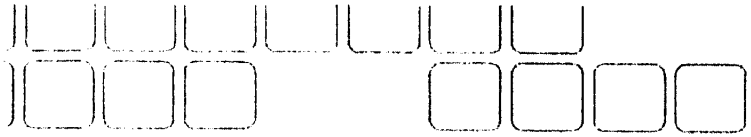
Development Tools



Integrated Tools Environment

Tool	Description
Compiler	C compiler
Simulator	Cycle accurate array simulator
picoSDL	Parser, assembler and elaborator
Plastic	Code placement, loading and switch programming tool
Netchecker	Pre/post placement connectivity check
picoGDB	Source level debugger
Parsnip	Multiple device code partitioning manager
Emulator	Device emulator





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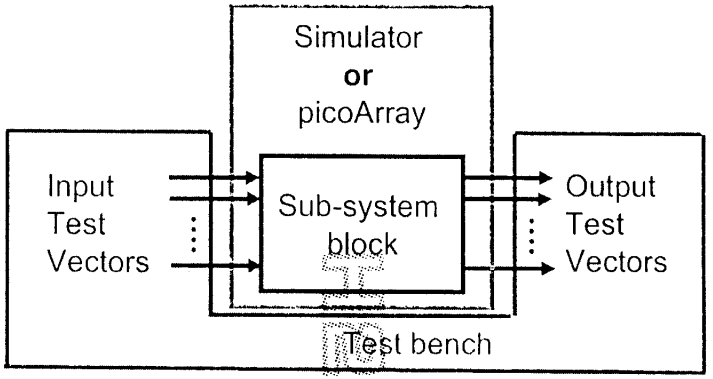
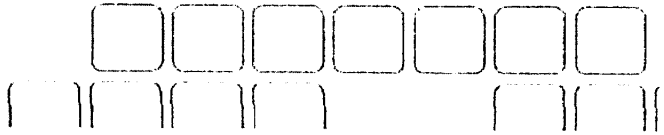
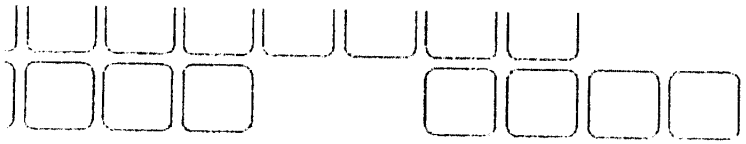
Accelerated Development: Simplified Test & Verification

- Systems are partitioned in sub-systems in the conventional manner.
- Stand-alone development test and verification of sub-system blocks in "hardware style"
- System integration is aggregation of blocks into larger blocks and verified in the same manner



- Test Vectors are **ONLY system-level signals** i.e. values carried by picoArray bus. There is **NO** synthesis or low level timing closure.
- Test benches can be run seamlessly on the Simulator and picoArray hardware.
- There is **NO** code rework for whatever the final hardware target.





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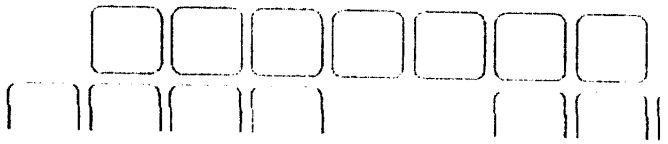
Development Kits



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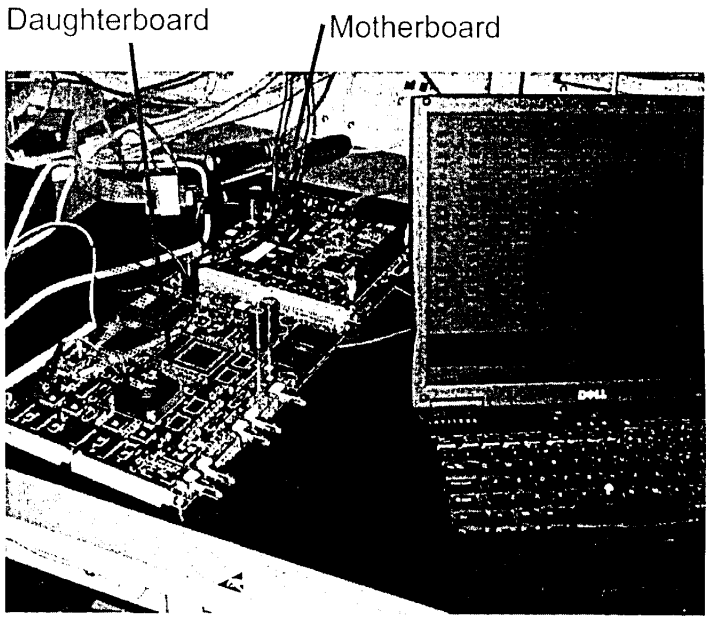
DVK-101 features

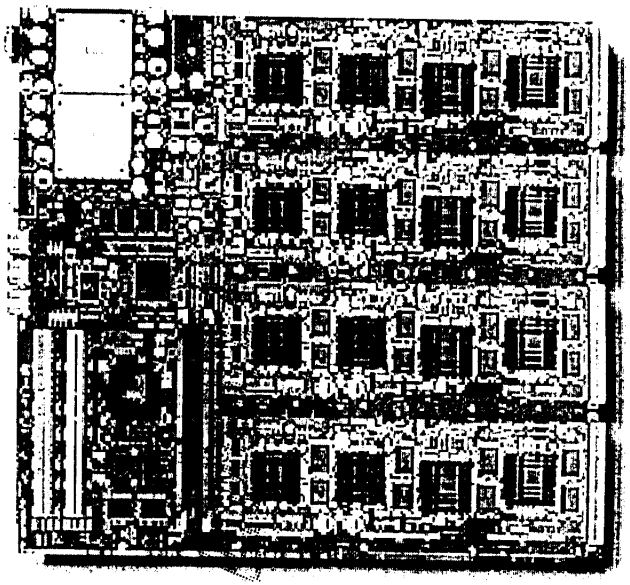
- Two interconnected PC101 devices
- 10/100base/T Ethernet for DVK to host interface for speed and flexibility. RS232 and JTAG interfaces are also available.
- AD 9862 data converters:
  - Dual 12-bit ADC at 40 Msps
  - Dual 14-bit DAC at 40 Msps
- Support for asynchronous data I/O
- IBM 405GP Power PC on the DVK motherboard to control the picoArray devices and the interfaces.
- IBM power PC handles DMA data I/O
- Local flash storage for picoArray configuration data



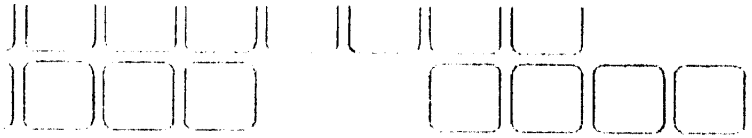
Availability: Now

SDP-101 Features

- Rapid prototyping of signal processing algorithms for implementation using picoArray™ technology
- Up to 4 Quad-picoArray™ modules
- 3300 Giga instructions per second total
- 488MHz Power PC processor with 2MB L2 Cache RAM and Marvell GT64260 System Controller
- 32Mb Flash for RTOS and picoArray™ config data
- 2 ECC DIMM slots for up to 512Mbytes SDRAM
- 2 uncommitted 66MHz PCI slots
- 3 RJ45 10/100BaseT Ethernet Ports, 2 RS232 ports
- 8 DMA channels for picoArray communication
- Single 48V power supply
- 8 asynchronous 16-bit parallel I/O data ports for multiple sources of high rate sample streams.
- VxWorks RTOS, PC Software library (Posix/Windows)
- Fully supported by proprietary software simulation and debug tools



Availability: May '03



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Flexible Ultra Broadband Radio Reference Designs

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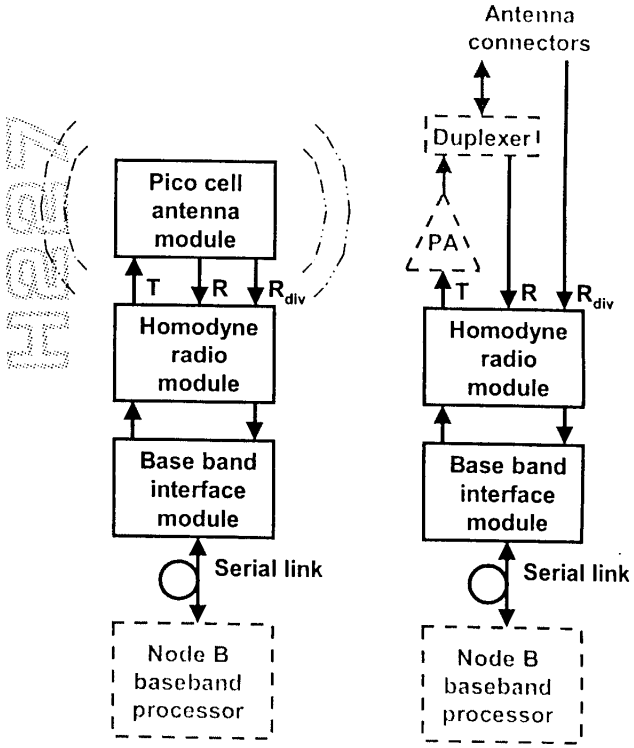
Accelerated Development: UMTS Radio Reference Design

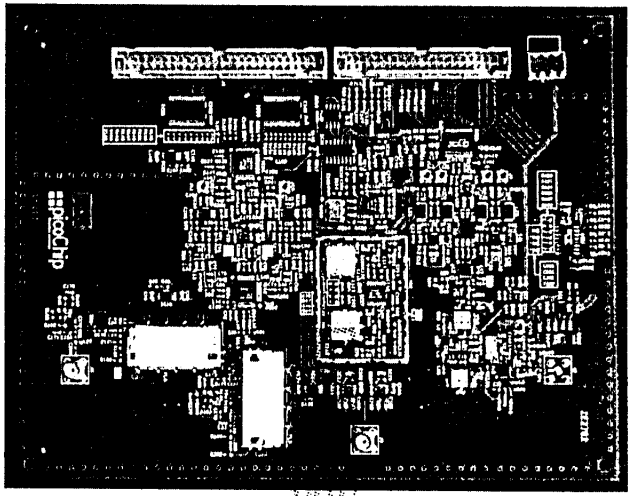
- Standalone, RF system with flexible interface for third party layer 1 units
- Low cost homodyne 3G radio architecture
  - Low power consumption
  - RRC filters with clipping in the transmit path
- Architecture scales from Picocell to Macrocell Node B applications
  - No duplexer required in the picocell variant
- TX/RX re-banded enabling 3G and a variety of other wireless standards.
- Fast serial link options for connection into third party Layer 1 unit
  - Reduced digital bandwidth at the serial interface, for fast serial transmission over cat 5 cable



Accelerated Development: Radio Reference Designs

Features

- A 3GPP TS 25.104 picocell radio including everything from the antenna connectors to a digital base band parallel interface.
- Integral 100mW picocell Node B RF power amplifier or a driver for an external microcell power amplifier
- SMA type RF antenna connectors for transmit and receive
- Compact footprint of 150mm x 215mm



Specification	Min	Typ.	Max	Unit
TX operating freq.	2110		2170	MHz
TX power		20		dBm
TX PAR supported		10		dB
RX operating freq.	1920		1980	
RX noise figure	3.8	4.5	6	dB

Reference Design Roadmap

Standard	Notes	Availability	
		Demo	Compliant
UMTS	FDD	**Now**	Q3 '03
	'Intelligent' FDD	Q2 '04	-
TD_SCDMA*	Standard Evolution Dependent	Q3 '03	Q4 '03
CDMA2000*		Q1 '04	Q3 '04

*** Dependent on Customer Demand**

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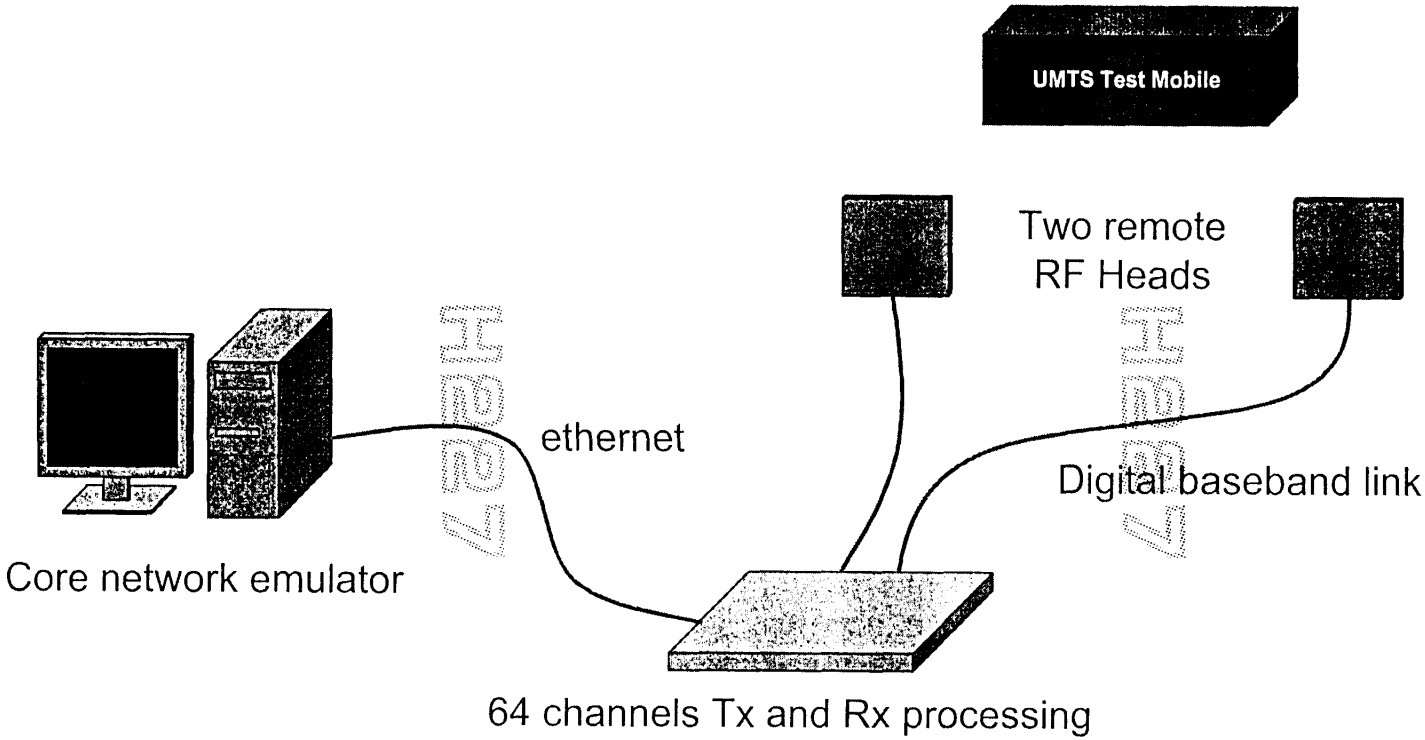
UMTS Node B Demonstrator

Demonstration Platform



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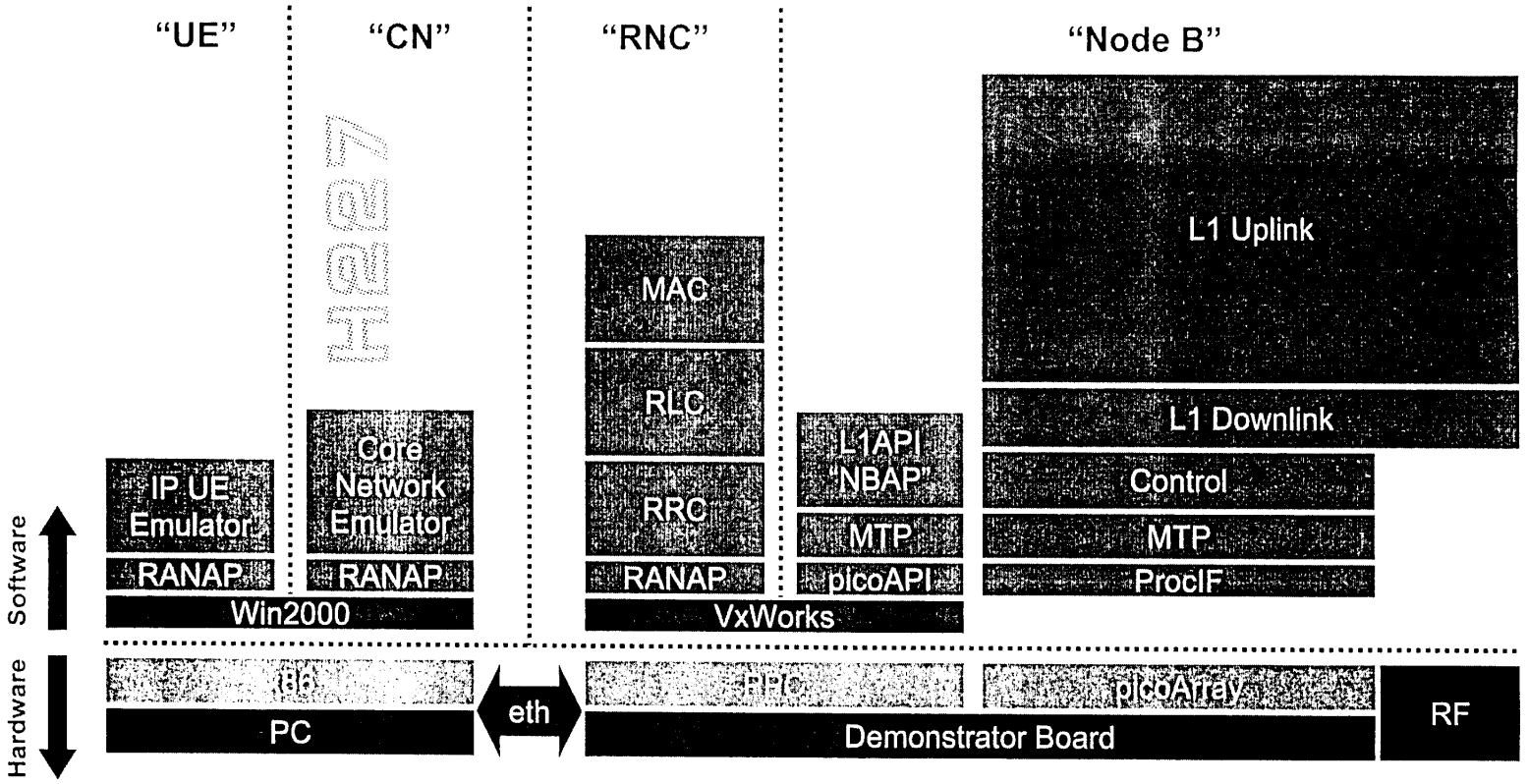
Demonstrator Components



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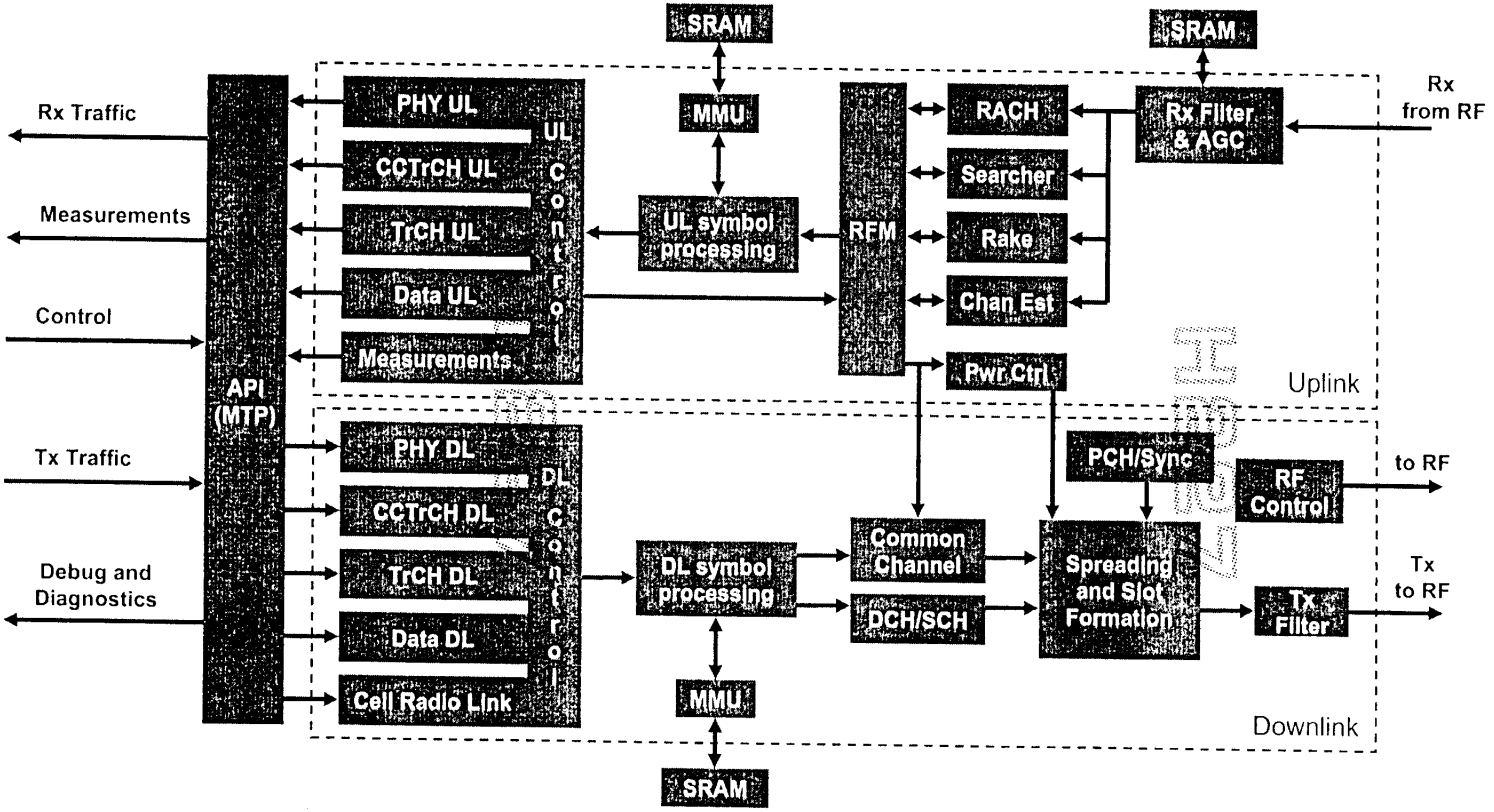
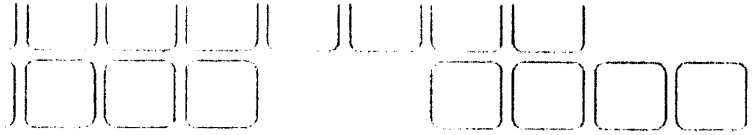
Demonstrator Baseband Software





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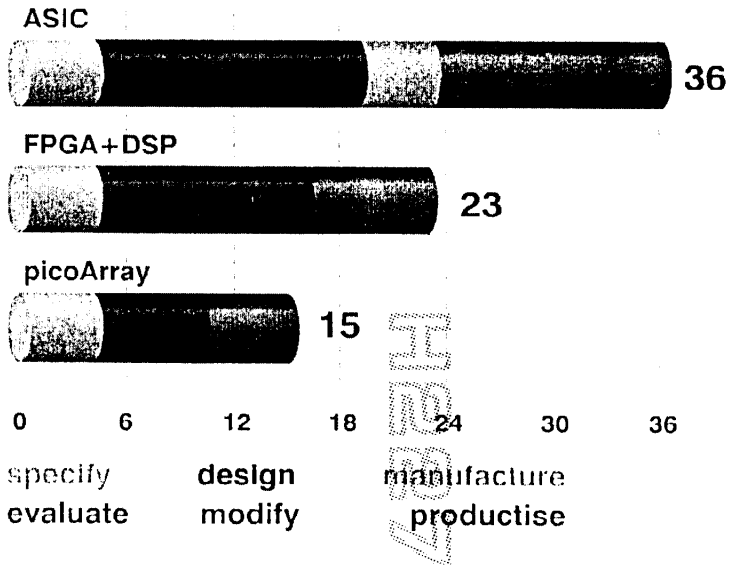
Benefits

Accelerated development: Integrated Tools and Components

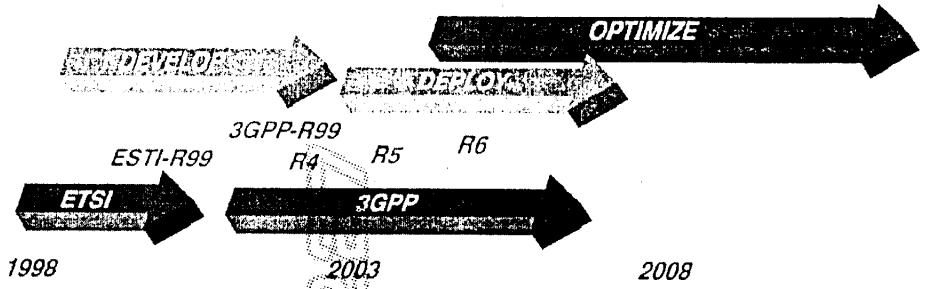
- No manufacturing time
  - Production code at the point of compilation
- Rich tools & libraries
- Rapid Development
  - picoArray Architecture dramatically simplifies design verification
  - Single design environment: no need for co-development or integration
  - standard C programming
  - Tools combines the best aspects of hardware centric (ASIC/FPGA) and software development flows



Time Saved = Time To Market = Time To Profit

Scalability, Flexibility, Multi-Standard

- **Benefits of a wholly software programmable Baseband**
  - Rapid development
  - Production Ramp Fix
  - Field Upgrade, RAN Tuning, 'Soft' Repair

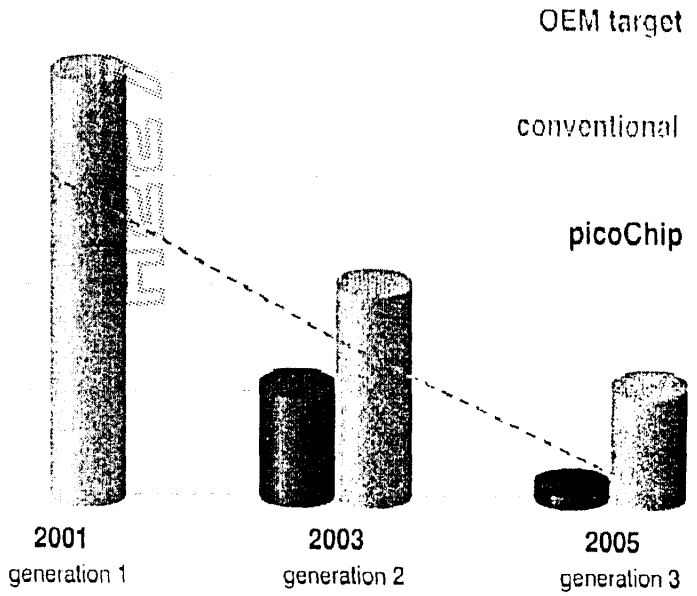


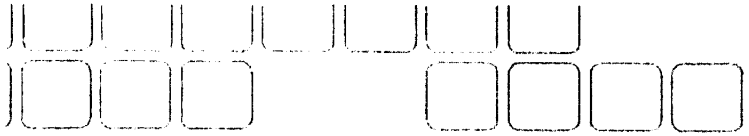
- **Standards evolving (Release 99, R4, 5, 6...)**
  - Currently, require "fork lift" upgrade. Substantial cost of obsolescence, maintenance
- **OEMs rapidly improving algorithms / Operators need in use flexibility**
  - "1dB is worth £1M per basestation to us". To date, limited practical experience of operation
  - Operators need to re-configure basestations during the day for traffic pattern usage
- **Platform for multiple markets**
  - Common development for different versions of basestation, Address distinct standards (eg WCDMA and TD-SCDMA) from one platform

Cost Savings: OEM Benchmark study results

Total Cost-Of-Ownership

- Evaluates value of flexibility to complete design, verification and manufacturing flow
- Compares "best in class" solution (DSP/ASIC/FPGA) including aggressive 30% ASP decline per annum
- Cost is $channel for complete WCDMA baseband
  - 192 channel 30km macro cell ("worst case")





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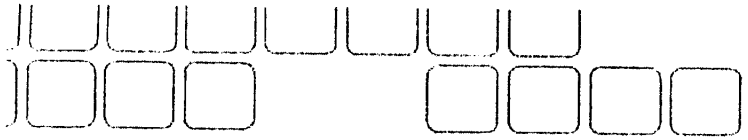
Product Portfolio Summary



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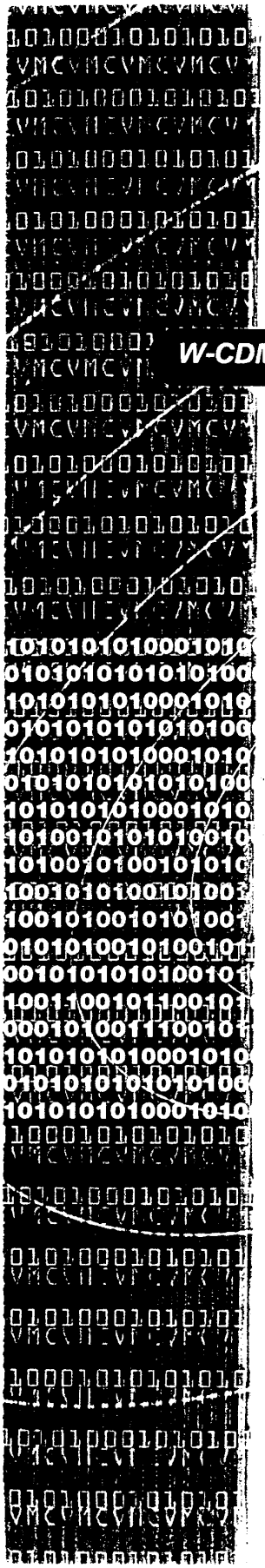
Product Portfolio Summary

- **The picoArray is the most powerful architecture yet devised for flexible wireless applications**
  - PC101 is **20** times processing performance of contemporary DSP's
- **Ease of programming, scaleable architecture, sophisticated tool suite and certified code libraries offer considerable savings across complete product development cycle**
  - Design
  - Verification
  - Early production modification/fixes
  - Field programmability and RAN tuning
- **Development Support for field product testing Q4 '03, production 2004**
  - Microcell & Picocell development
  - Multi-standard platforms

附件三



radiolab™ 3G

W-CDMA/UMTS FDD Layer-1 System Level Design Toolset

H227

Now with Licensable Source Code option

The Easier Way to 3G Design Success

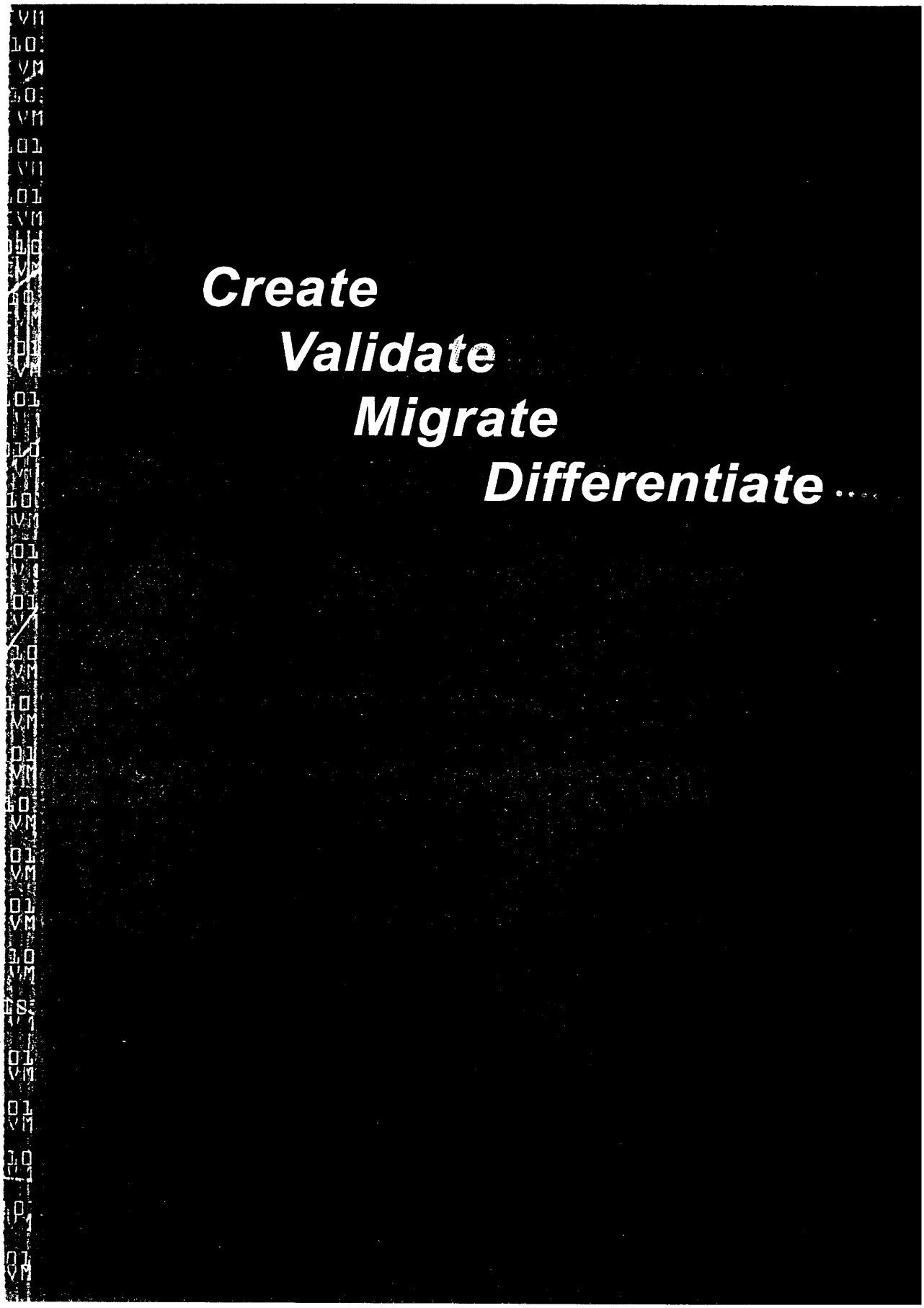
H227

Reference models for encoding/decoding 3G systems

Blocksets to build your own reference models

Supports fixed-point and floating-point calculations

SIMULINK® Enabled


Create
Validate
Migrate
Differentiate ....

H827

Accelerate your 3G Development

RadioScape's RadioLab™ 3G helps system design teams accelerate their W-CDMA/UMTS development. RadioLab's system level visual environment reduces the complexity of algorithm development by allowing engineers to view all of the interactions and dependencies present in sophisticated 3G systems.

RadioLab's simulations, which support both floating-point and fixed-point calculations, allow developers to validate their algorithms against pre-determined resource constraints before committing them to silicon: saving precious development time and resources.

RadioLab, built on The MathWorks® MATLAB® and Simulink® products, provides a unique tool for developers involved in the design, development and conformance testing of 3G products.

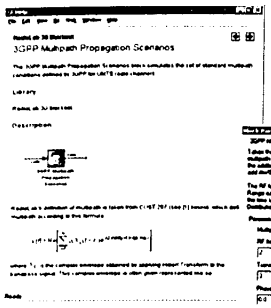
radioLab™ 3G

3 Easy Steps to Design Success

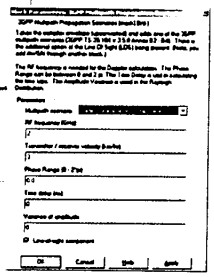
RadioLab's 3 easy steps to design success have helped systems designers develop W-CDMA/UMTS projects for next generation handsets and basestations.

From the moment RadioLab is installed it helps to shorten the development cycle by providing a productive visual environment for simulation. Within minutes you can begin to decipher the complexities of the 3GPP standard with RadioLab's on-line help and easy-to-use references back to the standard.

More importantly, RadioLab's predefined system blocks and reference systems allow you to begin running 3G simulations as soon as you have installed the software.



On-line help referncing the 3GPP spec



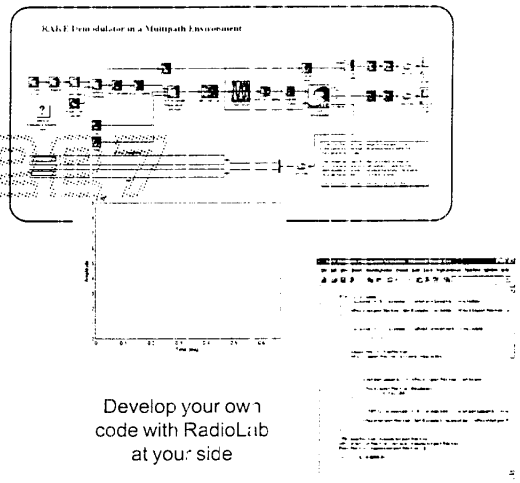
Adjustable system parameters for easy customisation

Create

With RadioLab's blocksets and reference systems as a guide creating the algorithms for your own system is easier and quicker than traditional methods.

Create your own algorithm blocks and place them into RadioLab.

Use RadioLab's fixed-point capabilities to help you make your silicon selection. RadioLab's support for fixed-point and floating-point simulations means that you can tailor your systems to meet the performance targets and characteristics of the silicon you have chosen.



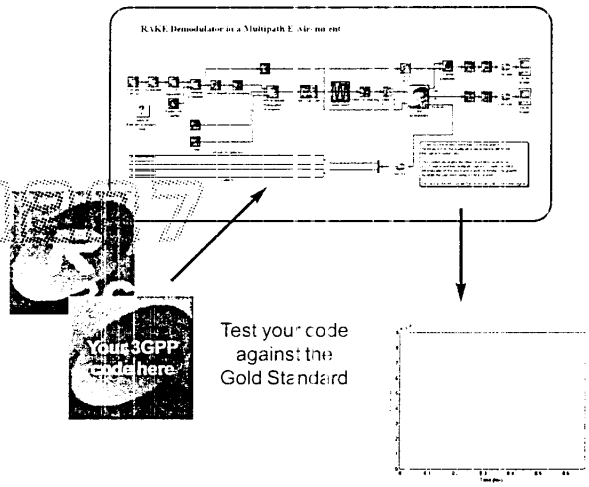
Develop your own code with RadioLab at your side

Validate

Use RadioLab blocks to validate your own code.

Create the algorithm block and test it in a variety of systems to guarantee your own system is working properly.

How does your code work in a 3G system? It's EASY-TO-SEE with RadioLab. No need to compile and recompile as with complex, homegrown C++ modelling tools.



Test your code against the Gold Standard

Migrate

Migrate your tested algorithms to your device development tool of choice. Moving your RadioLab designed and developed algorithms to their intended silicon targets is easy. Cut and paste your code to your chosen EDA tools (e.g TI Code Composer Studio).

Uplink and downlink physical channels modulation and demodulation

QPSK root-raised cosine pulse shaping

Simple fixed-point demonstration

Fixed point root-raised cosine pulse shaping

Uplink and downlink transport channel coding and decoding

The 3GPP specification details transport channels and how they should be built. The RadioLab model is an accurate representation of the processes shown in the specification. The model is used to investigate what happens to the data output when different types of data enter the transport channel. The model provides insight into how altering channel parameters affect the data stream.

Uplink and downlink transport/physical channel model

The system shows how transport and physical channels are linked for both encoding and decoding.

3GPP multipath scenarios

The 3GPP UMTS specification includes several different multipath propagation scenarios. The system allows the user to select the standard scenarios and investigate their properties. Contains several models from ITU — R M.1225.

RAKE demonstration

This model shows an implementation of RAKE processing and how it can be used in multipath coherent recombining. The model supports variability of several parameters, including the number of RAKE fingers. Included is a peak search algorithm that examines the multipath signals and determines which signal is strongest.

Bursty UMTS transport channels

Bursty data is a key feature of UMTS transport channels. The system shows how our XML based approach can be used to provide bursty data under the user's control. This bursty data is then channel coded and decoded.

Uplink and downlink UMTS physical channels

This simple models show how the uplink and downlink physical channels are spread, scrambled, and combined and the resulting constellation diagram. The user can change the block parameters at any point in the simulation

Uplink and downlink rate matching multiple transport channels

This system models multiple transport channels being channel coded, rate matched and combined together. The signal is then subjected to noise, and then de-rate matched, and channel coded. The user can select the channel coding options including 1/2 or 1/3 rate convolutional coding, or turbo coding.

Downlink Node B to UE *NEW*

This reference system builds on the UMTS FDD downlink physical channel mod/demod system, which shows how a handset can decode a specified signal from a Node B based on the orthogonal spreading codes. Here, a handset detects a data channel in the presence of two Node Bs, each transmitting two data channels. Scrambling codes are used to differentiate between the Node B transmissions. As in the previous system, the spreading codes are used to differentiate between a Node B's two data channels

Random access channel tasking *NEW*

Demonstrates how PRACH and AICH are used to set up a connection between a UE and a Node B. At random intervals, the two UEs here initiate the random access procedure by sending PRACH preambles to the basestation, increasing the signal power each time they fail to receive an acknowledgement in return. Simultaneously, the basestation is processing any preambles it detects and acknowledging them with AICHs. Once a UE has one of its preambles acknowledged, it switches to transmitting the PRACH message, which is processed by the basestation. When the procedure is completed, a UE becomes inactive again, before deciding to send another PRACH after some random time and restarting the procedure.

radioscape

Making WAVES

radioscape

CVM®

Communication Virtual Machine

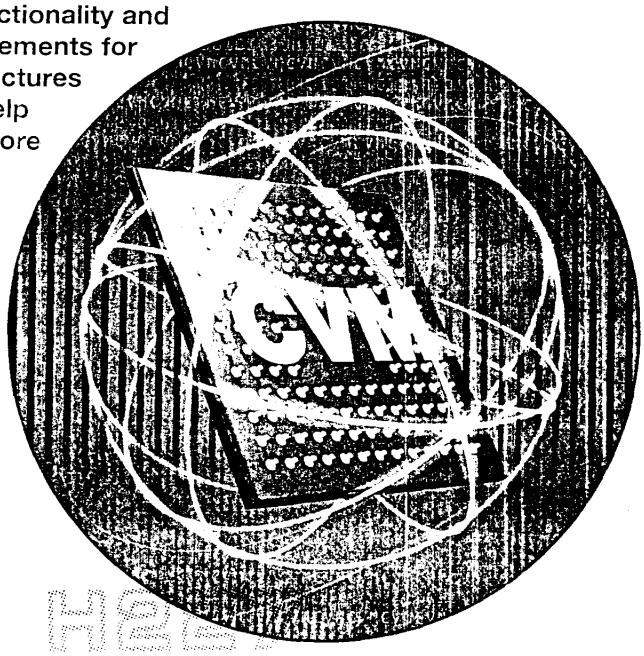
radioscape

Making waves

radioscape

CVM: Solving Wireless Systems Design Complexity

RadioScape's Communication Virtual Machine™ (CVM™) enables semiconductor manufacturers and their customers to develop wireless products more quickly and reliably. With the rising complexity of wireless standards, an increasing need for multimode functionality and growing requirements for parallel architectures the need for help has become more critical.



The CVM helps semiconductor vendors and their customers manage this complexity through its native support for multimode integration and powerful parallel architecture brokering capabilities.

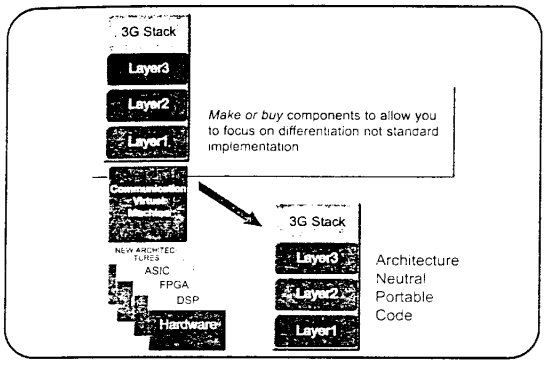
The CVM technology provides development processes and a runtime kernel for developing complex, real-time applications, such as those required by the current and next generation of communications equipment. The CVM technology delivers a structured, modular and extensible approach for developing and integrating time-critical applications with minimal overhead. CVM achieves this by separating the data-dependent complexity and high-MIPs requirements of advanced DSP/FPGA/ASIC algorithms, from the application-specific control framework that requires access to these algorithm resources.

The CVM Runtime Kernel

CVM is a runtime kernel that enables and integrates multimode wireless operations, manages parallel architectures and provides a unique approach to wireless systems development. The CVM runtime kernel manages system complexity and offers significant additional benefits to the developers at each stage of the design process. These benefits include a normalized RTOS interface layer which facilitates easy portability of wireless communications stacks and a development methodology which supports design proving, performance optimisation and emulation capabilities in a re-entrant design flow.

The CVM is licensed to semiconductor manufacturers and is included within their wireless systems designs. The CVM adapts itself to the individual systems that it is supporting. That adaptation is trained into the CVM through the course of the design process and results in a run-time kernel that is completely aware of the software protocols running above and the hardware and software resources available within the baseband.

Key technology benefits:



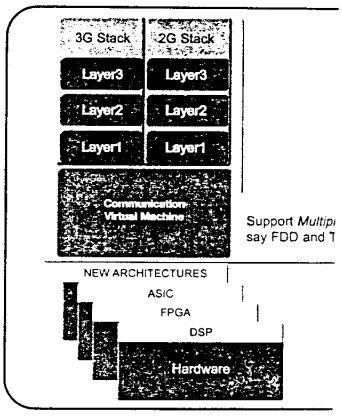
Allowing OEMs to focus on differentiation

Portability Simp

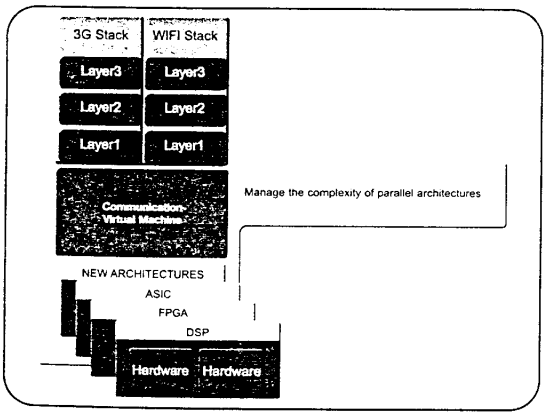
Wireless developers invest mu
money creating software suppc
communications. Unfortunately
investment is discarded as dev
easily migrate their code to ne
The CVM helps developers by
portability of code from one ge
the next saving time, developn
at the same time increasing de

Integrating Multimode Wireless

Supporting multimode integration is easy with the CVM because it is trained to know about the resources available within the baseband system. Rather than hardcoding engine calls to particular hardware or software-based algorithms the protocol stacks communicate their requirements with the CVM which manages the use and scheduling of the baseband to support multimode operations. The CVM is aware of co-resident stacks and adjusts its use of system resources in line with this knowledge.



The CVM manages the multimode int



The CVM Brokers Parallel Architectures

Brokering Paral

As the complexity of wireless
the ability to design single chi
solve these problems decreas
parallel system architectures t
processing needs of the supp
creates system management
wireless system designers. Th
through the development proc
underlying baseband and und
the partitioning decisions mad
system design. With this knov
the CVM can schedule and
manage single and
multimode applications
over a complex,
parallel system.

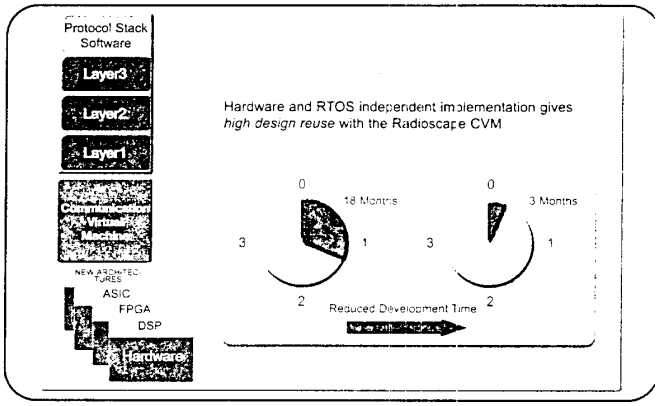
radioscape

CVM

RadioScape's CVM enables development of multi-vendor, complex, real-time DSP applications in a hardware-neutral fashion.

For next generation complex and/or parallel DSP applications, the CVM manages complexity and gets product to market faster because:

- It brokers parallelism in multi-core, multi-processor, and accelerated designs;
- It allows stack designs to be completed with interchangeable hardware and software acceleration;
- It allows the interoperability of multi-vendor, hard real-time intellectual property at both the 'whole-stack' level and the 'stack-component' model, making SoC a reality;
- It allows the production of truly portable communications stacks that can be simultaneously offered onto multiple vendor hardware platforms;
- It provides flexible-policy statistical scheduling for optimised resource usage;



Speed of Implementation Improved

... while at the same time offering compatibility with existing component frameworks and third party design tools.

RadioScape Ltd. develops and licenses intellectual property for the wireless communications market. Our core technology, the Communication Virtual Machine™ (CVM™), enables rapid development and deployment of complex communications products by semiconductor companies and protocol stack developers.
Founded in 1996, RadioScape's investors include Royal Bank Ventures, Scottish Equity Partners, Atlas Venture, Texas Instruments, JAFCO, ntl: and Psion.

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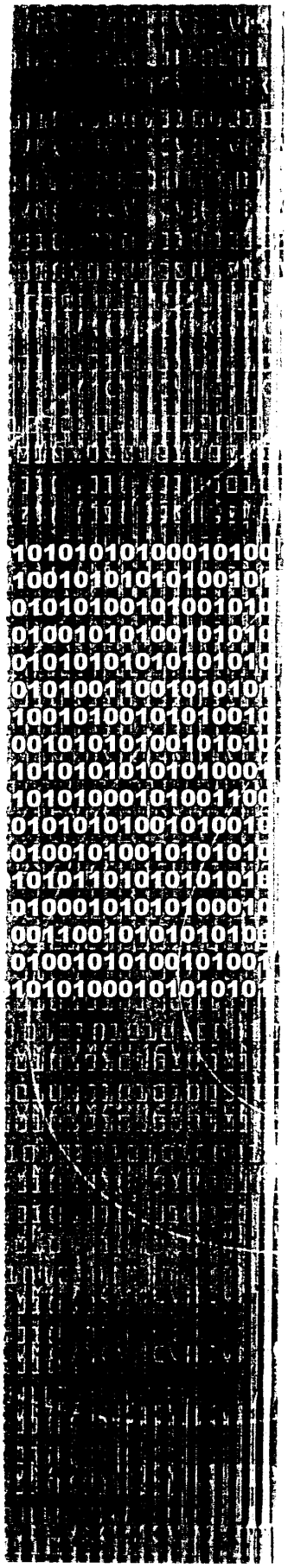
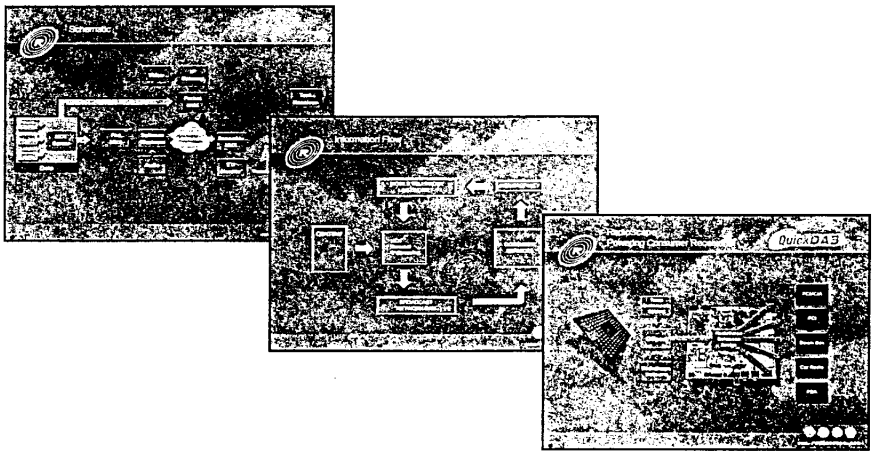


radioscape®

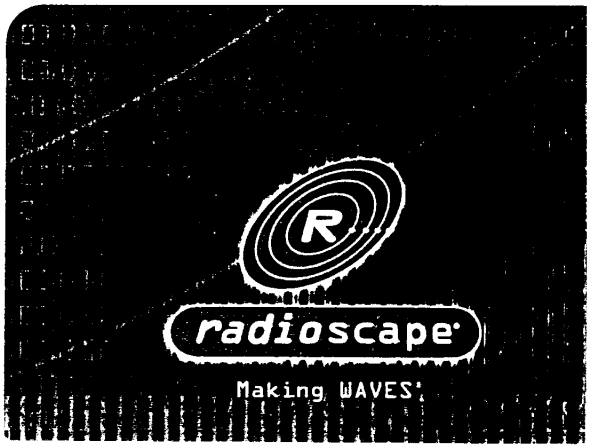
Making Digital Radio a Reality...

...from Broadcaster...



H227 QuickDAB

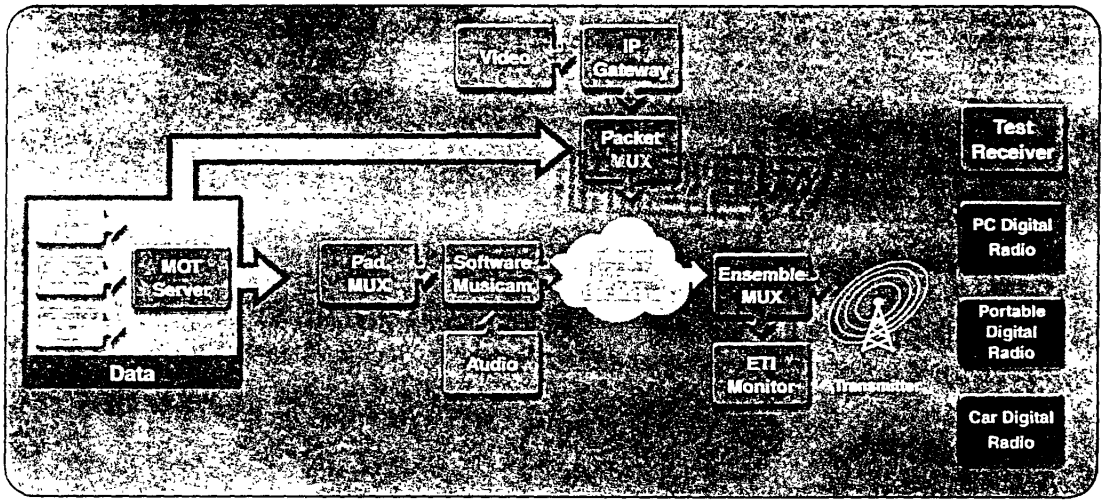
...to Consumer.



DAB
DigitalAudioBroadcasting

The RadioScape DAB Suite

The RadioScape DAB Suites provide a flexible, reliable and easy-to-upgrade solution for the management and generation of DAB services.



The **RadioScape® Data Suite** is a set of tools for data generation that supports Packet and Stream mode data broadcast and includes Multimedia Object Transfer and IP Streaming encoders. The suite also provides APIs to allow additional customized data applications developed by broadcasters or studios and data content generators to plug into existing equipment

The **RadioScape Studio Suite** provides a software musicam encoder with Audio over IP (AoIP) output to the RadioScape Broadcast Suite. Together with audio processing, XPAD encoding (e.g. Dynamic Label Segment, DLS) and Service Information signalling modules this suite provides a comprehensive solution for every DAB broadcaster.

The **RadioScape ETI/NA Monitor** allows active monitoring of a DAB ensemble before it is converted to RF. The monitor provides access to service provisioning metrics and alarms on the ETI stream and its contents and can link to the Broadcast management software to validate the current signal

The **RadioScape family of Test Receivers** can monitor, record and provide alarms on a DAB signal and its contents to a service engineer for immediate or scheduled fault resolution

The **RadioScape Transmission Test Suite** creates a complete broadcast network from Studio to RF within the confines of a laboratory environment. The Transmission Test suite is ideally suited to testing the Texas Instruments DRE family of radio receiver chips developed in co-operation with RadioScape

Value added software rounds out these product offerings with embedded support for IP streaming for datacasting and support for an electronic program guide.

The individual product components which make up these suites are

- Multimedia Object Transfer (MOT) Server
- Software MUSICAM
- Programme Associated Data (PAD) Multiplex
- Packet Multiplexer (NPAD)
- Main Ensemble Multiplexer(EMUX)
- Broadcast Management Software
- Ensemble Transport Interface (ETI) Monitor
- Broadcast Remote/Local Test Receiver
- Research Grade Test System

RadioScape's software approach to design and development of critical broadcast technology makes upgrading to new features and functions to support new revenue opportunities easier for our customers than for those who choose traditional hardware-based solutions

RadioScape's software-based technology can be rapidly adapted to support all of the emerging digital radio services including Digital Radio Mondiale (DRM), In-Band On-Channel (IBOC) from Ibiquity in the US and satellite services being rolled out worldwide

radioscape

Making WAVES®

Full descriptions of all of these products can be found on our website, www.radioscape.com

radioscape®

Delivering Innovative products

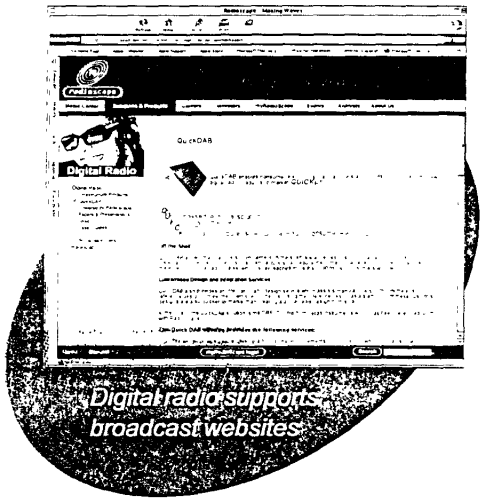
RadioScape's professional digital radio broadcast products deliver service provisioning solutions to Eureka-147 broadcasters and infrastructure providers. Our products are used daily, worldwide to support broadcast digital radio services and are offered wherever digital radio is being adopted.

Designed using the capabilities of software defined radio (SDR) RadioScape's DAB implementation provides flexible solutions for digital radio transmission, reception, monitoring and ensemble management. The power of these solutions is enhanced by their ability to run over a standard IP data network.

Our software approach leverages internet technology to distribute audio and data from studios and other content providers to the Ensemble network provider. This technology allows our customers to benefit from mass-market solutions supporting IP data network design, installation, monitoring and redundancy supported by internetworking leaders like Cisco Systems™. This internet capable solution enables the control of radio transmissions using industrial grade PC platforms which are co-located with the broadcast equipment or can be conveniently located remotely anywhere over the network.

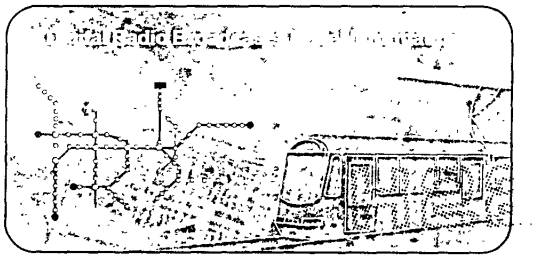
RadioScape's technology is being used to deliver digital radio services on the world's largest commercial digital radio network: Digital One™. Digital One's network started service on 15 November 1999 and has been running continuously without interruption ever since.

Datacasting for DAB



Datacasting over DAB is one of the biggest revenue opportunities for studios and broadcasters. The low cost of the airwaves and the broadcast nature of digital radio provide a unique opportunity to deliver high-quality data services to consumers. From news and sports reporting to stock reports, weather and up-to-the-minute traffic information the power of DAB to deliver information is enormous. Advertising services over DAB will provide even greater revenue opportunities

Digital radio's ability to support free and low-cost subscription based services make it unique in the telecommunications wireless marketplace The emerging capability for dual mode digital radio and GSM handsets will drive forward a new front for the m-commerce market free data delivery of advertising over digital radio. GSM can provide a call-back service to support the purchase of advertised items

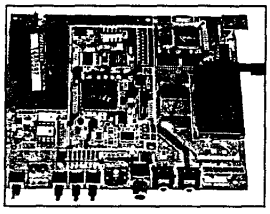


VIADAB: The open data standard

RadioScape is driving the datacasting revolution over DAB with its VIADAB standard for interfacing data services onto a DAB service. Developed in conjunction with the BBC and supported by the United Kingdom's Department of Trade and Industry (DTI), VIADAB provides an easy-to-use open API for development of data services for Eureka-147.

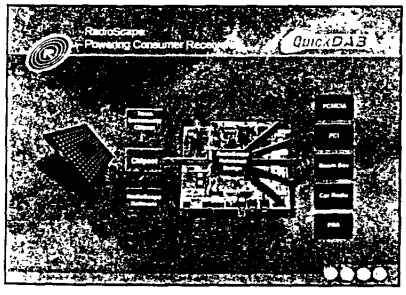
RadioScape Consumer Radio Technology

RadioScape has introduced design and integration services for consumer electronics manufacturers interested in building Eureka-147 consumer radios.



The QuickDAB service, which is built around the Texas Instruments DRE200 developed with software from RadioScape, enables manufacturers to deliver products to market more quickly. The DRE200, which is available directly from Texas Instruments, is the lowest-cost and lowest power chip on the market today.

QuickDAB offers manufacturers the choice of an off-the-shelf reference design or customized integration services to combine the DRE200 reference designs with existing radio designs combining AM/FM, CD player and a variety of other features and functions which consumers expect Using tested and proven reference design enables these QuickDAB customers to bring new DAB radios to market more quickly.



TI Third Party Network Member

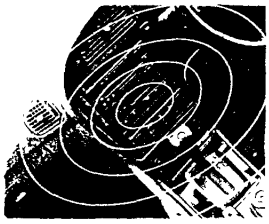
DSP

TEXAS INSTRUMENTS

Manufacturers can combine the QuickDAB service with the RadioScape Transmission Test Suite for product testing and verification. The Transmission Test Suite creates a complete broadcast network from Studio to RF within the confines of the product test laboratory. QuickDAB builds on RadioScape's success in the DAB consumer electronics market and follows our successful work with Psion™ on their innovative digital radio WaveFinder™.

Wireless MP3

Real-time Wireless MP3, another RadioScape patented innovation for consumer digital radios, is being used in the WaveFinder™. Today consumers can download and record music over the airwaves in MP3 format for playback at a later time MP3 recording and playback was once only the domain of internet radio and on-line music distribution engines. RadioScape's patented MP3 transcoder makes this exciting technology, already the darling of audiophiles and generations of consumers, available for all wireless users of digital radio.



附件四

3G End-To-End Data Flow Demonstration

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Objective of the Demo

- **To demonstrate End-To-End call setup and data flow for PS Domain using HSS RNC integrated interfaces and SGSN-GGSN**
  - Includes signaling flow setup for the end-to-end(UE-SGSN) connection
  - Data path setup using the Transport Network Control Plane
  - PS data flow on the path setup between UE and PDN
- **To demonstrate the functionality all the HSS RNC Interfaces(Iub, Iu, Uu), broadband stacks, Data plane stacks, ALCAP and 3G SGSN**
- **To serve as a sample demo application for using HSS RNC interfaces and building a RNC**

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Demo Scenario

PS Call Setup and PS data session

- **UE powers on and sets up an RRC Connection with the UTRAN. UE is moved from the IDLE to CELL_FACH state by RNC.**
- **UE registers with the SGSN by sending ATTACH request.**
- **UE initiates a PS data session by sending PDP Activate Context request to the SGSN. RNC sets up the radio bearers for data transfer between UE and PDN.**
- **On successful activation of PDP context and setup of RABs, packet data transfer takes place between UE and PDN.**

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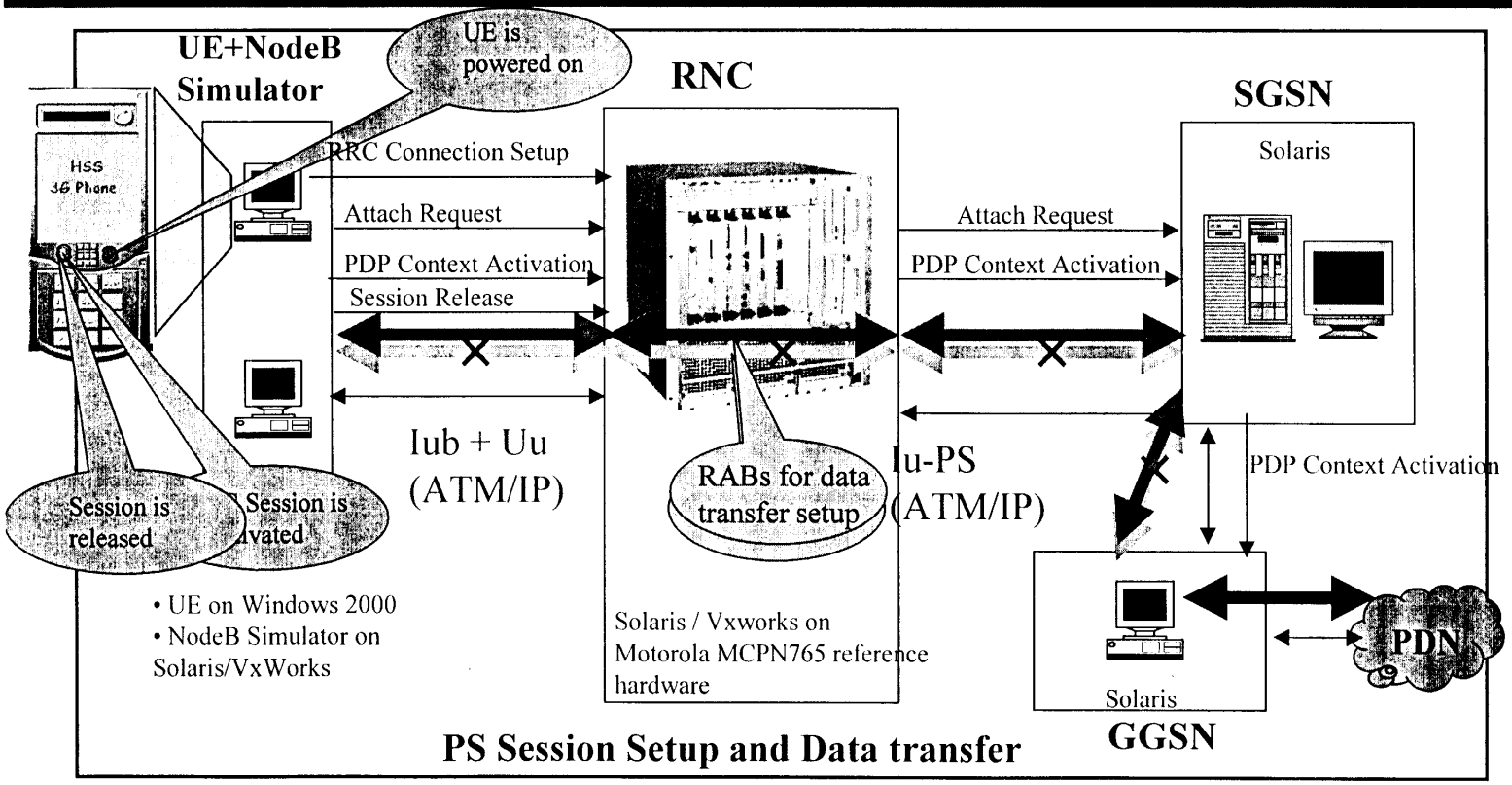
Demo Scenario



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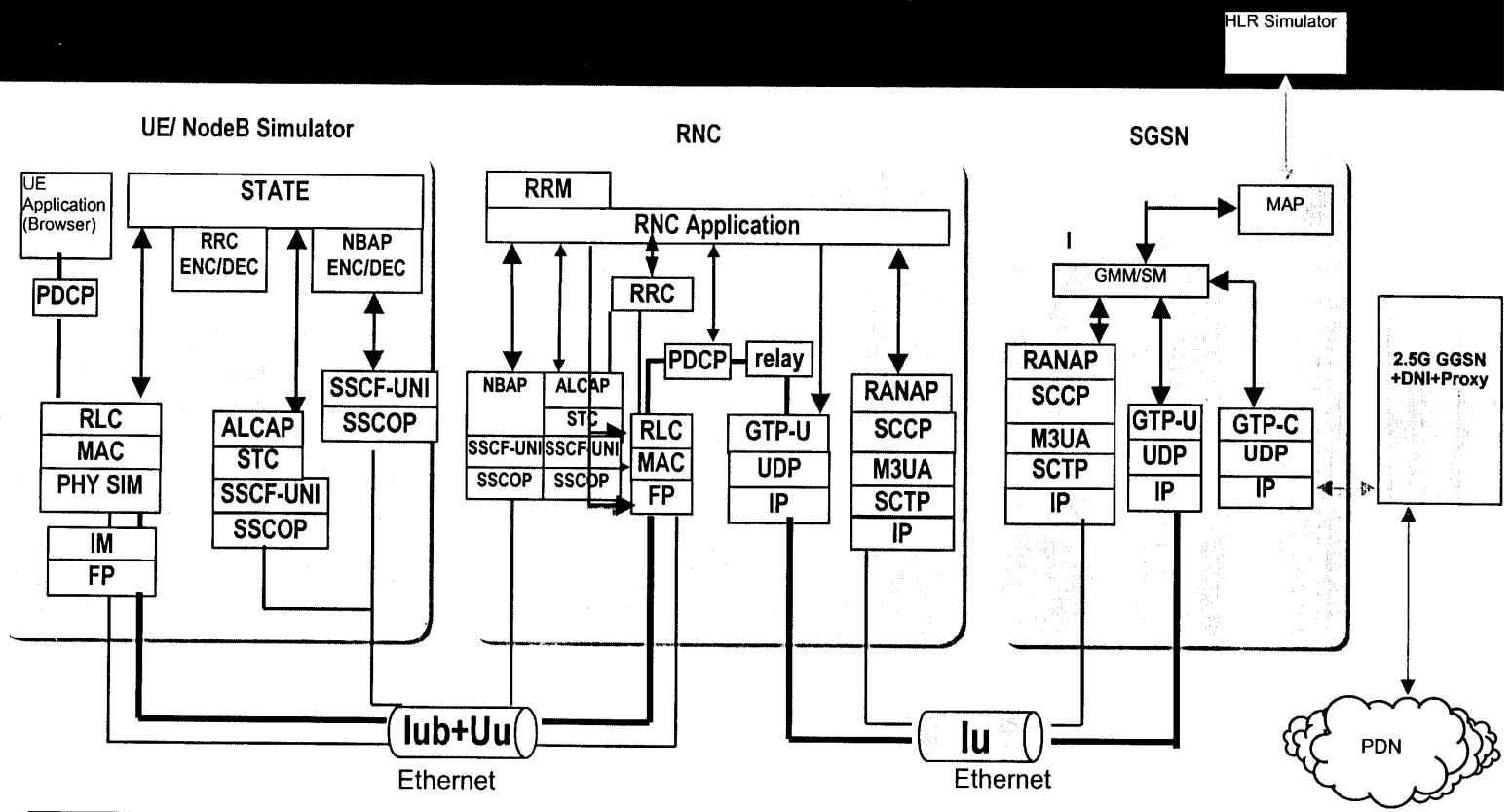
Solaris Setup



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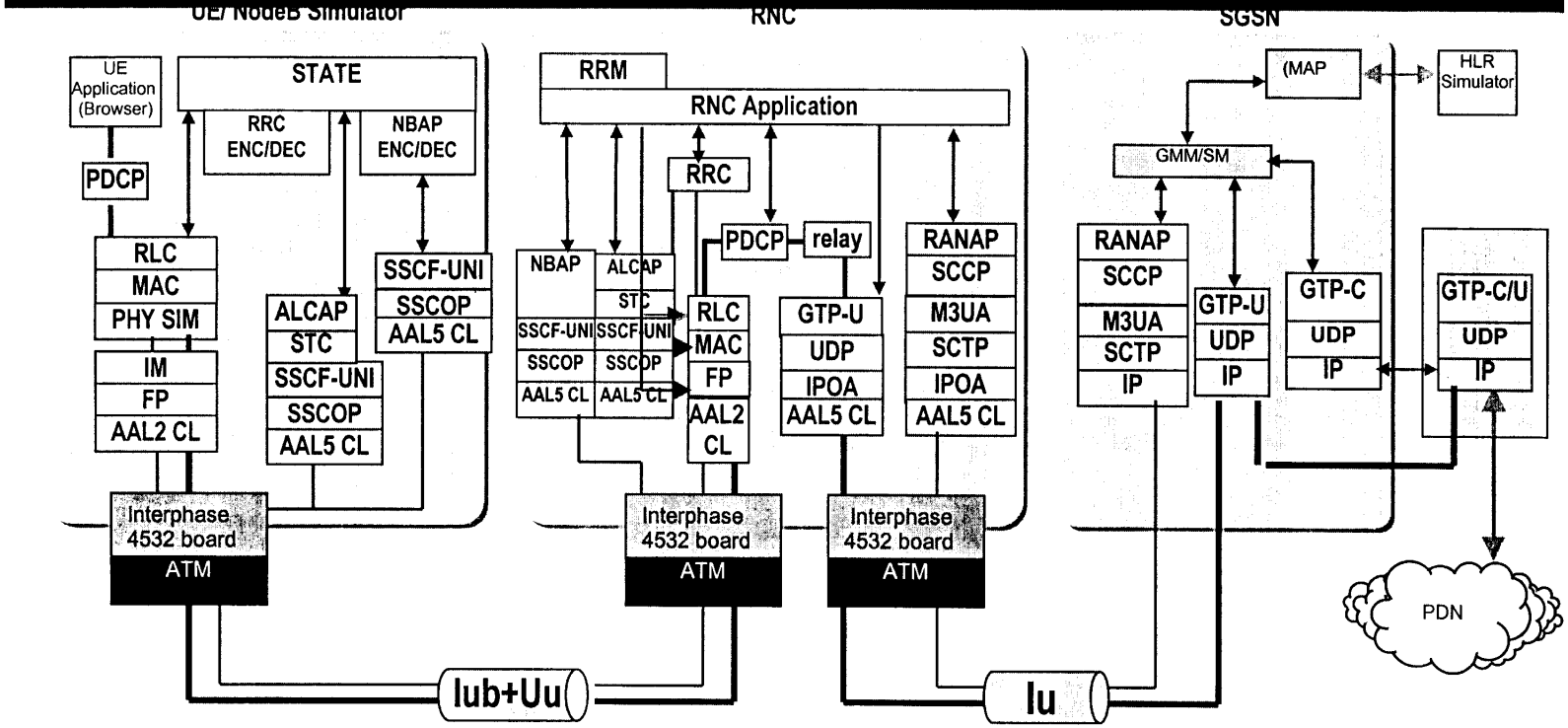
VxWorks Setup



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Demo Setup Features

- The protocol stacks in the demo setup are 3GPP Rel 4 compliant
- The demo scenario is for PS session. However, the protocol stacks and integrated interfaces support CS interface as well.
- Air interface is simulated on IP over ethernet

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Nodes of Demo Setup

- **The demo setup involves the following Nodes:**
  - **RNC**
    - **Control Plane :** HSS Iu, Iub, Uu Signaling Interfaces
    - **Transport Network Control Plane :** HSS ALCAP Interface for setting up data path on Iub Interface
    - **Data Plane** : HSS FP, RLC+MAC, PDCP, RNC GTP-U
    - **Sample RNC Application**
      - Single UE context across RNC interfaces
      - Co-ordinates all the Signaling and Data Interfaces at RNC Node
      - Implements proper Sequencing of protocol/interface message flow to setup end-to-end signaling connection from UE to CN
      - Configures GTP and PDCP
      - Interfaces with RRM simulator to get the radio resource parameters

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Nodes of Demo Setup

- **UE + NodeB**
  - **Iub Control Plane**
    - SAAL UNI + STATE with NBAP Encoder/Decoder
  - **Iub Transport Network Control Plane**
    - ALCAP Interface for setting up Data Bearers
  - **Iub Data Plane**
    - Iub Framing Protocol
    - Interface Module for mapping FP to the PHY Adapter Layer of UE. It also allows multiple UEs
  - **Uu Control Plane**
    - UE RLC + MAC on top of PHY simulator
    - STATE with RRC Enc/Dec simulating RRC
  - **Uu Data Plane**
    - PDCP + UE application Simulator

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Nodes of Demo Setup

- **CN**
  - **Iu Control Plane**
    - HSS 3G SGSN(at Iu Interface), GGSN Simulator, HLR Simulator
  - **Iu Data Plane**
    - SGSN GTP-U

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Demo Flow

- **RRC Connection Setup**
  - UE placed in Cell_FACH State
- **Signaling Connection establishment**
  - Initial Direct Transfer triggered from the UE resulting in connection to CN(SGSN) through RNC
- **RAB Setup**
  - RAB Assignment Request from the CN
  - Radio Link Setup on the NBAP
  - Data Bearer setup through ALCAP on the Iub Interface
  - RB Setup on the Uu Interface
  - Setup of PDCP & GTP entities .
  - UE moved to CELL_DCH State
- **Data Transfer on the established RB**
  - Data initiated from the UE to CN
  - Data loopback at the SGSN and received at UE
- **Signaling Connection and Data Path Release**

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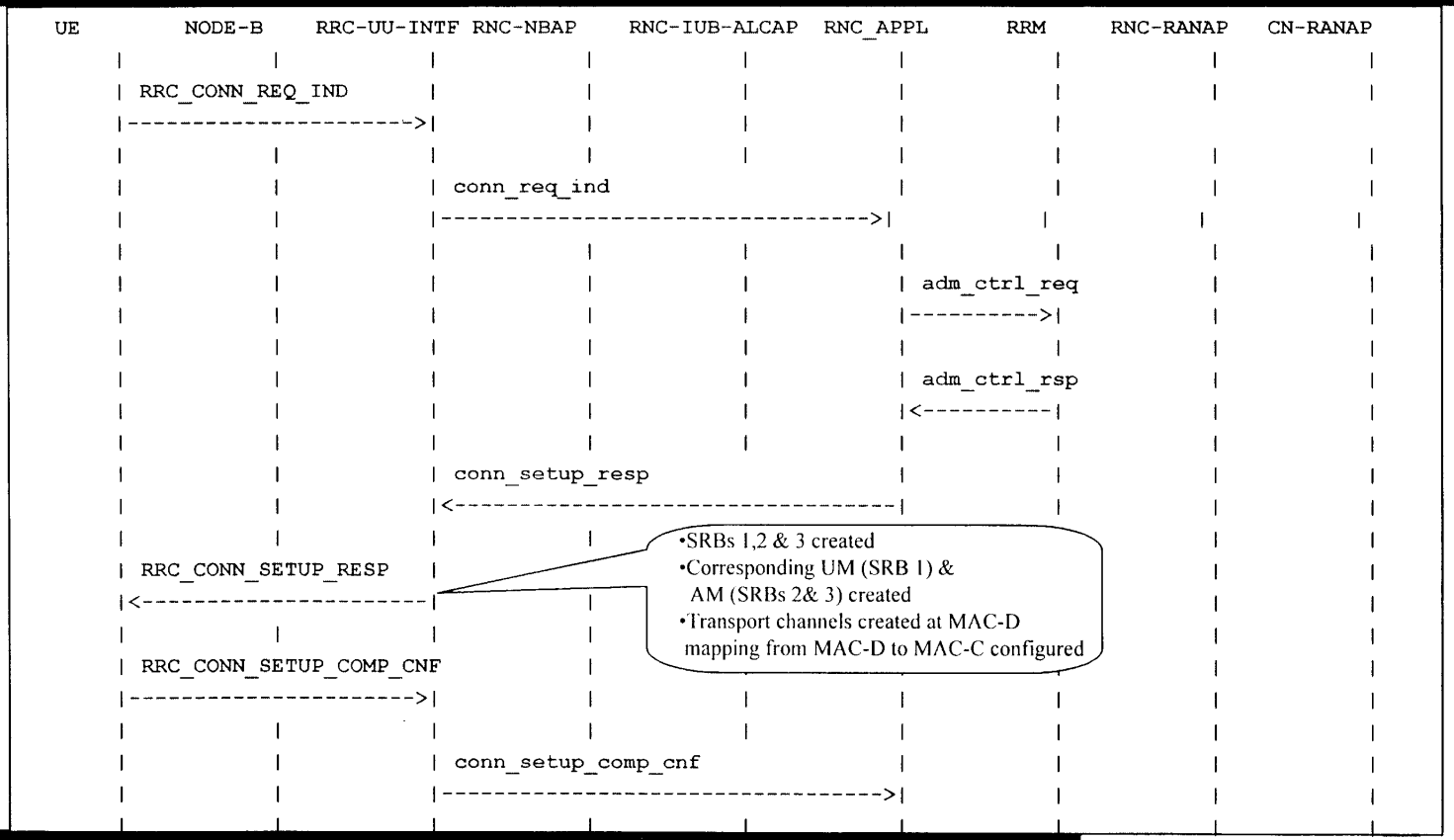
Demo Flow (RRC Connection Setup)



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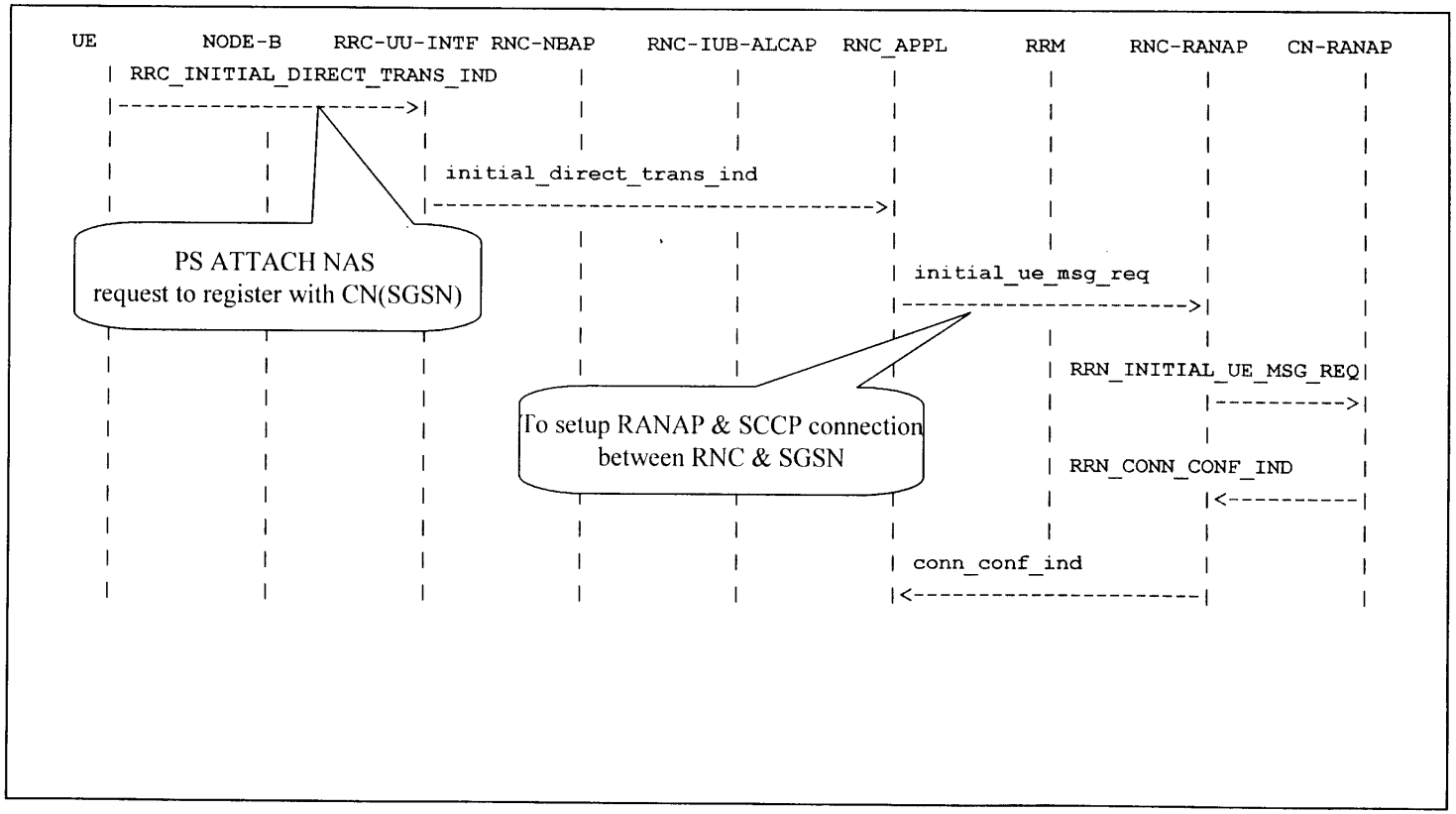
Demo Flow - Iu Connection Setup



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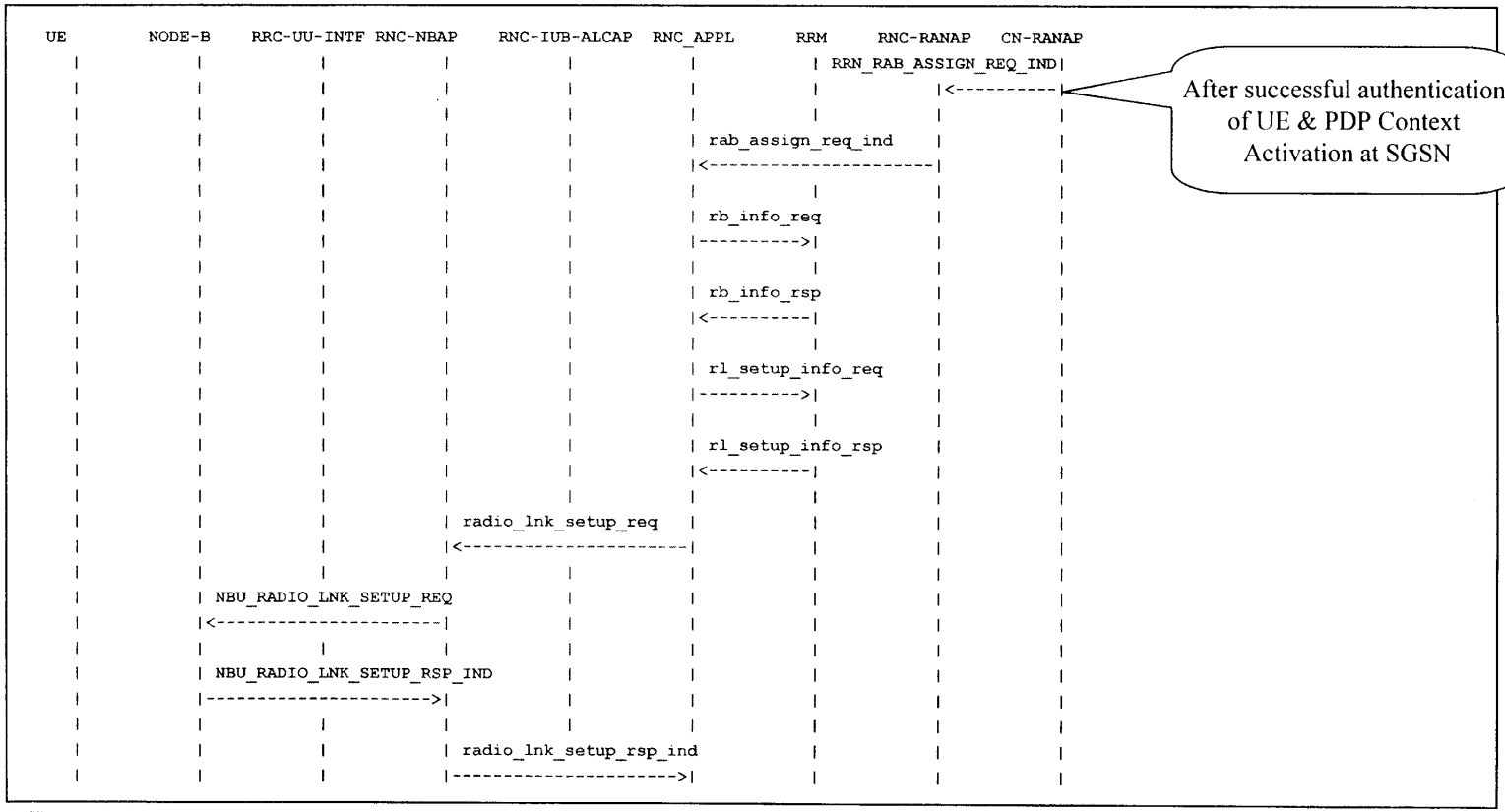
Demo Flow - Radio Link Setup



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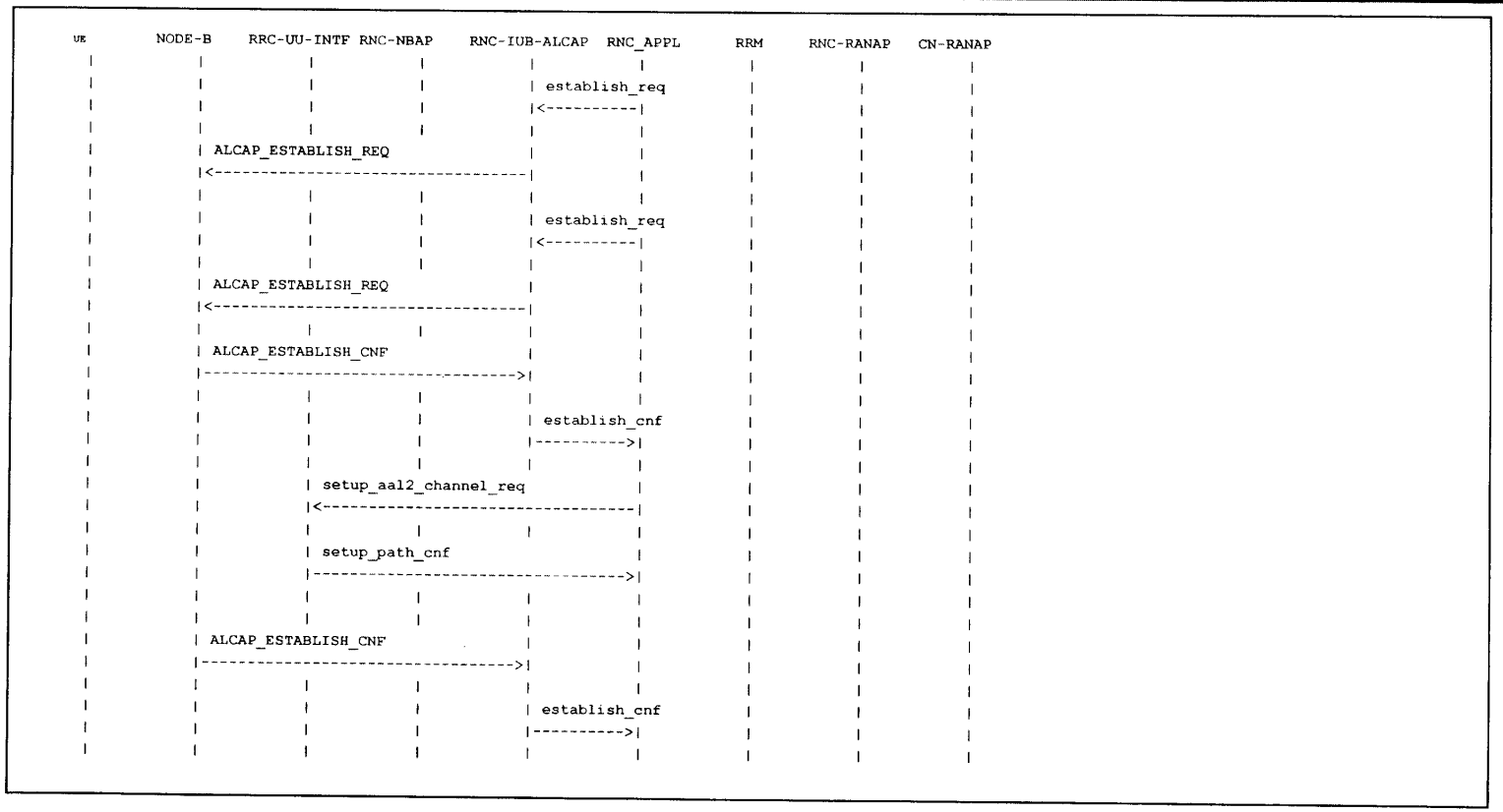
Demo Flow - Data Bearer Setup



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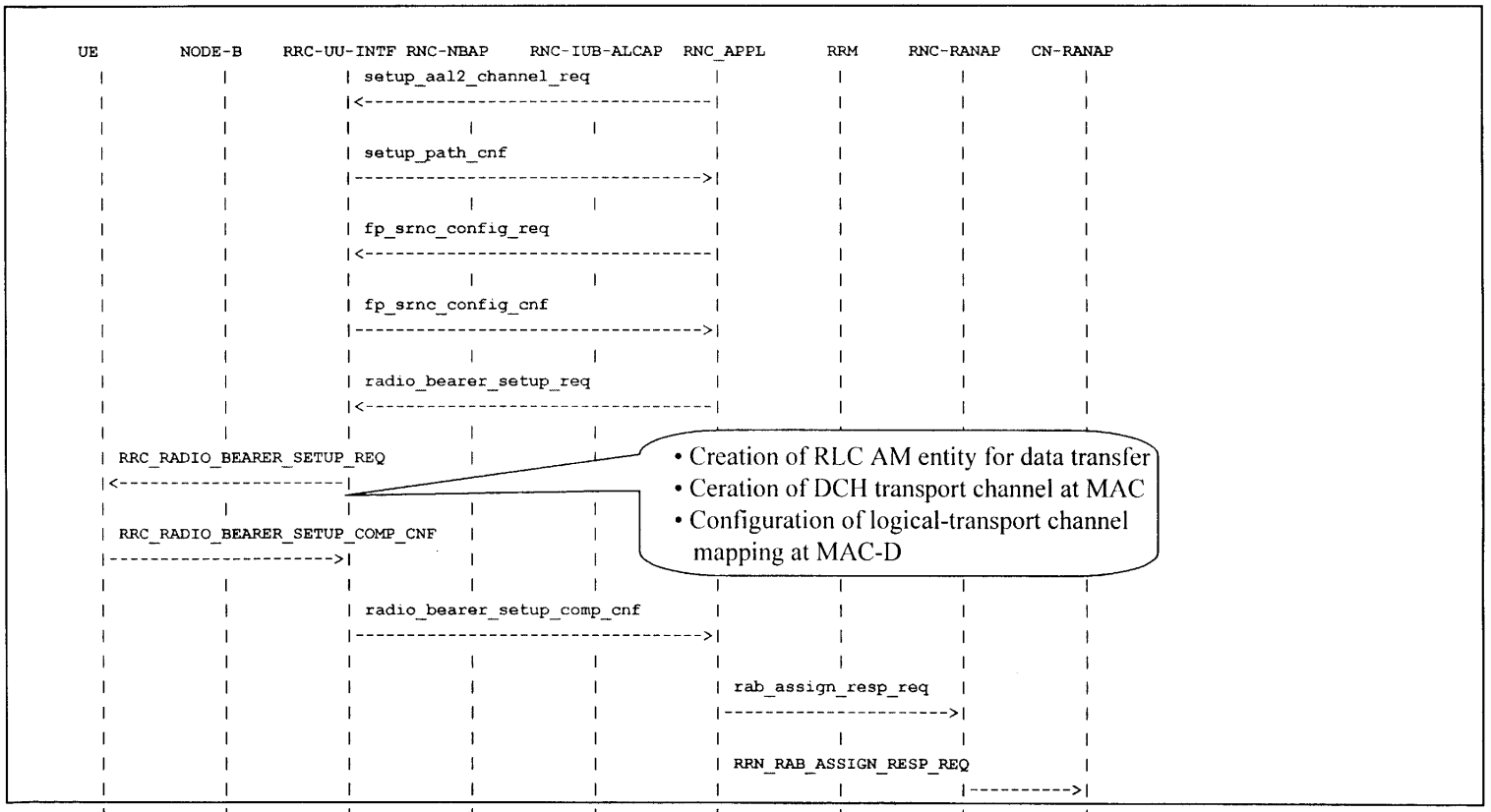
Demo Flow - RB Setup



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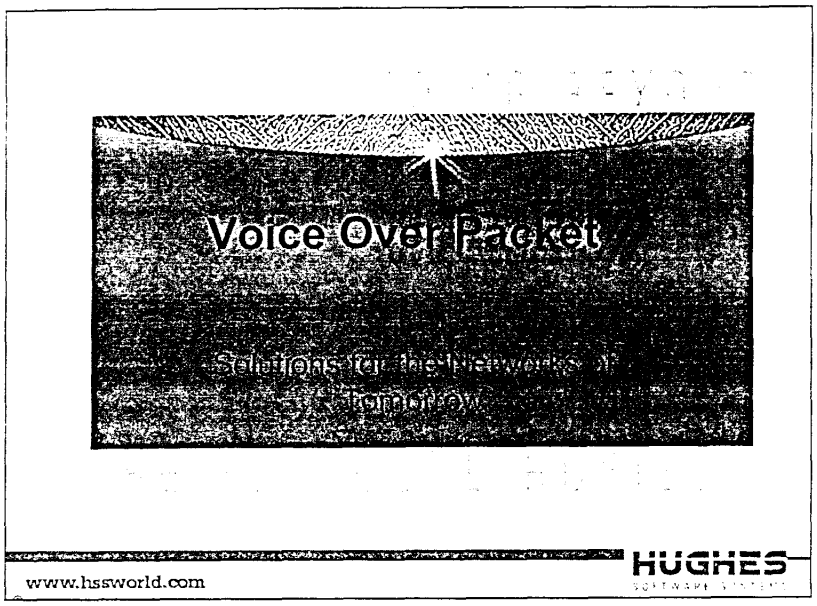

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Our Voice over Packet Business

Software Technology to Connect users
for Voice and Data in Converging networks

Soft-Switch
SIP Server
Gatekeeper
Protocol Stacks and Toolkits

Solutions for Emerging and Converging Networks

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The HSS Advantage

- Targeted for high performance embedded systems
- Reduced time to market
- Porting and integration support
- Product architecture design support
- Sustained R&D investment
- Guaranteed Interoperability
- Active participation in Standards bodies
- Members of SIP Forum, International Soft-switch Consortium, National Convergence Alliance, ETSI, 3GPP
- Installed base of more than 150+ customers

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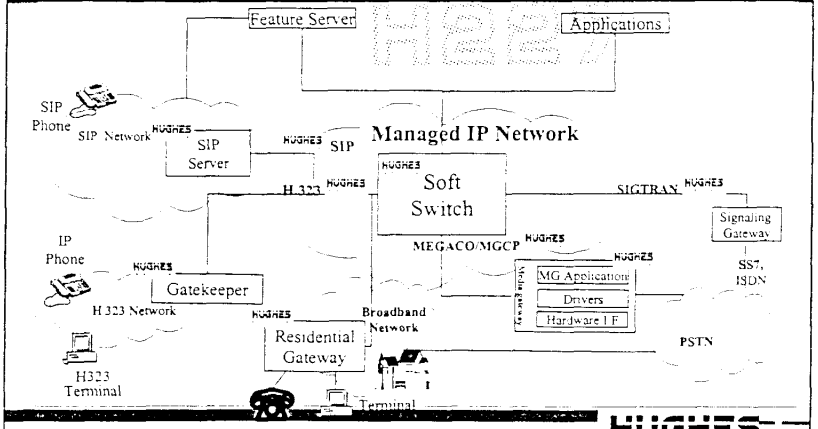
Overview of the future



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What do we offer

Frameworks

- SIP Server
- Gatekeeper
- Soft-switch

Toolkits

- MEGACO based Media Gateway
- SIP User Agent

Protocol Stacks

- MEGACO
- MGCP
- SIP
- SIGTRAN (SCTP, M2UA, M3UA, IUA, SUA)
- H.323

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Key benefits

Protocol Stacks

- MEGACO
- MGCP
- SIP
- SIGTRAN (SCTP, M2UA, M3UA, IUA, SUA)
- H.323

- Reduced time to develop
- Reduced cost of development and maintenance
- Ensures interoperability across vendors

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Key benefits

Toolkits

MEGACO based Media gateway

H.248

SIP User Agent

- Increased productivity
- Reduced time to develop
- Reduced cost of development and maintenance
- Ensures interoperability across vendors

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Key benefits

Frameworks

H.248

SIP Server

Gatekeeper

Soft-switch

- Reduced time to deploy
- Reduced cost of development and maintenance
- Ensures interoperability across vendors

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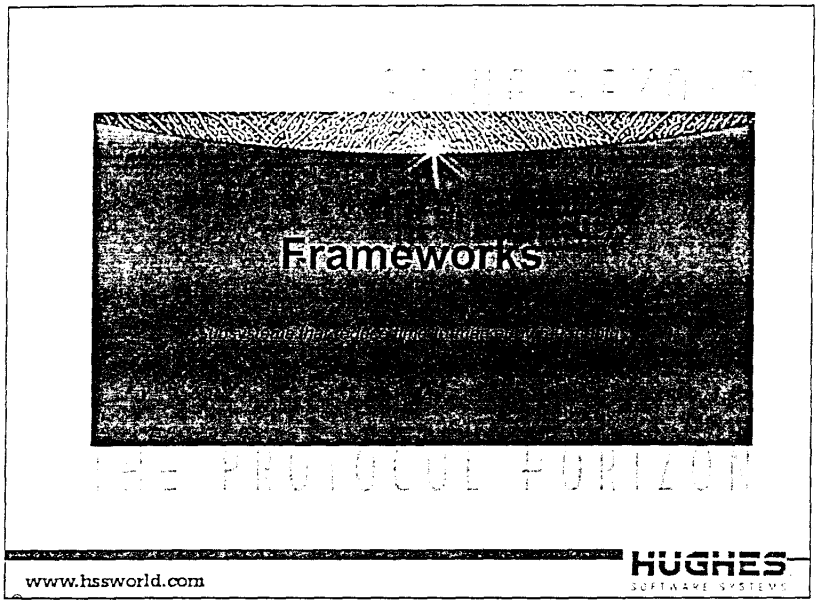

SIP Server

Enhances the SIP stack functionality to enable full featured SIP devices

- SIP Server Development Framework (SDF) implements the core functionality of the entity being developed
- SDF exports API's to the user that can be customized to any need
- SDF can be used to develop SIP proxy, registrar,Location servers, redirect servers , B2BUAs, AppServers etc.

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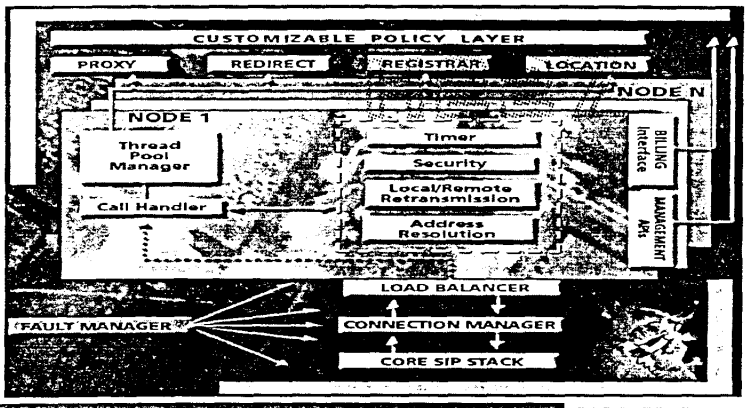
SIP Server Architecture



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SIP Server Salient Features

- Dynamically switches modes based on policy (eg from stateless to stateful based on domain name)
- LDAP, DNS SRV support
- Highly configurable XML based file
- Distributed architecture
- Basic, MD5 authentication
- Easily customizable to plug and play new components
- compliant to ISO C++ and EC++ specifications

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Gatekeeper

Fully compliant with H.323v2, IMTC's Now! Interoperability effort and ETSI's TIPHON specifications

Key functions

- Address translation
- Admissions control
- Bandwidth control
- Zone management

Additional functions

- Call control signaling
- Call authentication
- Bandwidth management
- Call management
- Supplementary services

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Softswitch

Call Agent Framework

Conforms to TIPHON Distributed Gateway Architecture

- Generic Call Control to support diverse signaling protocols and interworking between protocols
- Media Control remotely through MEGACO & MGCP
- APIs for rapid deployment of services
- Support for CLASS4, CLASS5 and IP Services
- Support for SS7, R1/R2 and ISDN PRI network interface

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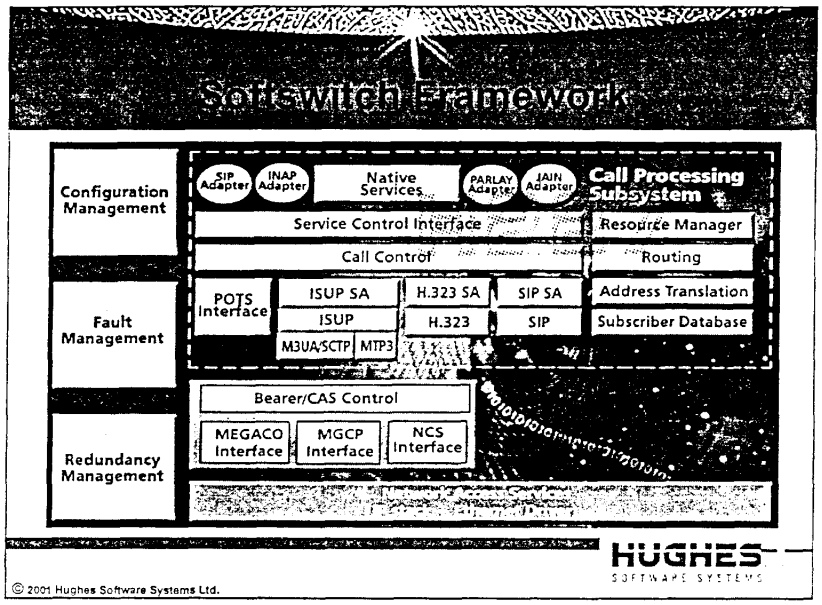
Softswitch Framework
Configuration Management
Fault Management
Redundancy Management
SIP Adapter
INAP Adapter
Native Services
PARLAY Adapter
JAIN Adapter
Call Processing Subsystem
Service Control Interface
Resource Manager
Call Control
Routing
POTS Interface
ISUP SA
H.323 SA
SIP SA
Address Translation
ISUP
H.323
SIP
Subscriber Database
M3UA/SCTP
MTP3
Bearer/CAS Control
MEGACO Interface
MGCP Interface
NCS Interface
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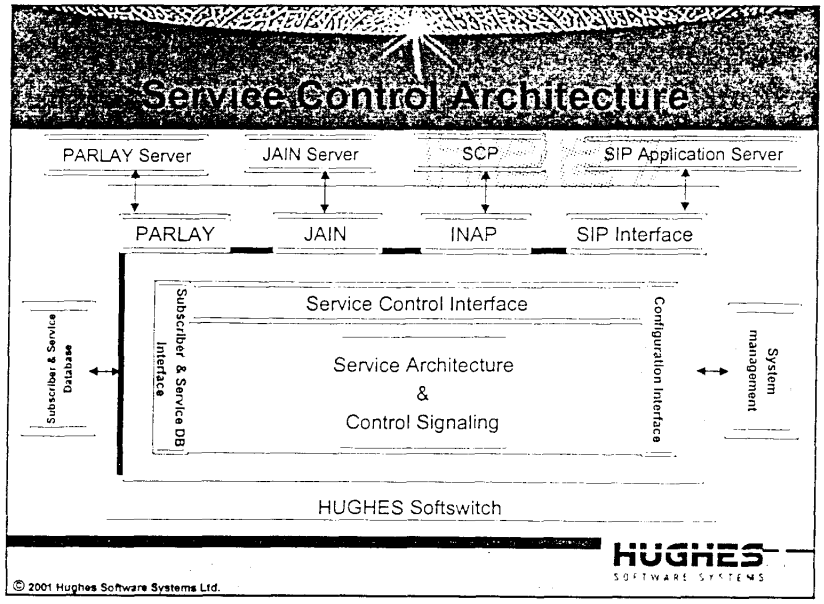
Service Control Architecture
PARLAY Server
JAIN Server
SCP
SIP Application Server
PARLAY
JAIN
INAP
SIP Interface
Service Control Interface
Service Architecture
&
Control Signaling
Subscriber & Service DB Interface
Configuration Interface
System management
Subscriber & Service DB
HUGHES Softswitch
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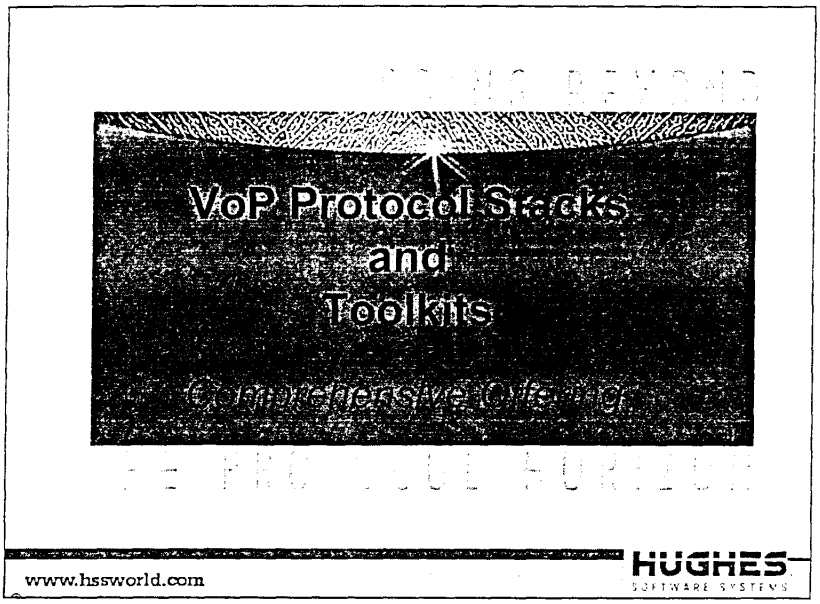

Architectural Features

- Based on Advanced Architecture for Protocol Engineering (AAPE™) Framework ensuring
  - Modularity
  - Multiple Architecture Support
  - Portability
  - Scalability
  - Error reporting, Statistics collection & Trace support
  - Multiple build options

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Debugging Support

- Support for multiple levels of tracing
  - Detailed Trace, Brief Trace
- Support for configuration of all stack parameters, such as transport layer timers
- Support for Statistics collection
  - API Statistics
  - Protocol Statistics
  - Internal Event Statistics
  - Error Statistics
- Support for Error Reporting
  - Multiple Error Levels (Critical, Major, Minor)
  - Multiple Error Types

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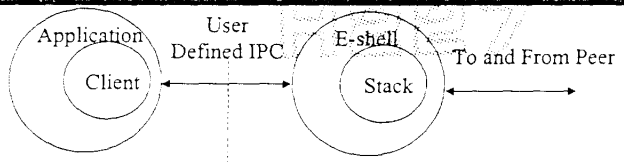
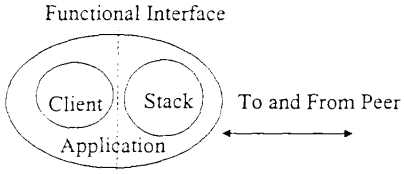
Integration with Application



Application and Stack in different Contexts



Application and Stack in same Contexts

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MEGACO Stack

Implements MEGACO Functions

Conforms to current standards (H.248)

- Text and Binary Encoding/Decoding services
- Transaction Management
- Transport Management (ALF over TCP & UDP)
- MG-MGC Association Management
- Security (AH within MEGACO)

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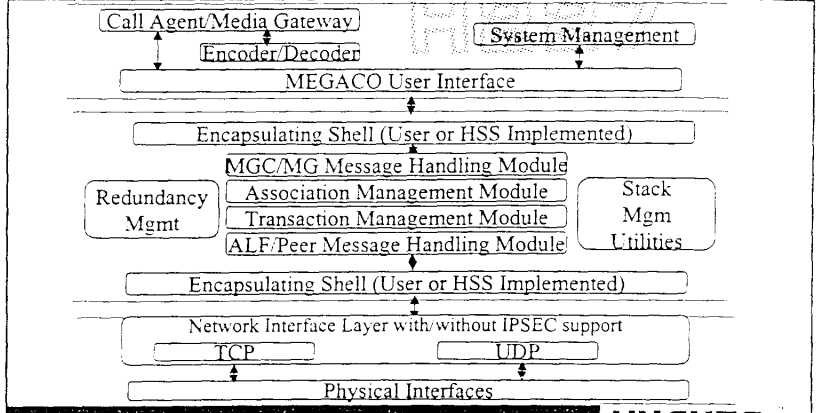
MEGACO Stack Functional Block



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MEGACO Toolkit

- Platform agnostic middleware
- Hides syntactic and semantic details of the protocol processing
- A step above the conventional protocol stacks in the value chain
- Requires focus on specific application profile requirements and building glue code to platform

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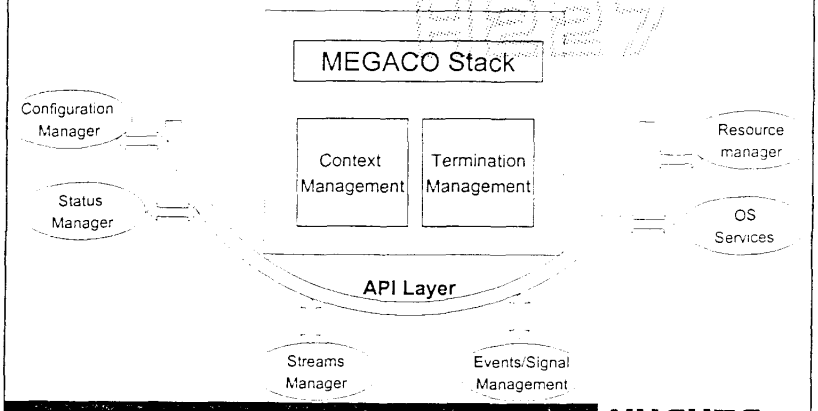
Toolkit - Functional View



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MGCP Stack

Conforms to RFC 2705

Supports PacketCable Network-based Call Signalling (NCS) Profile

- Transaction Management
- Encoding & Parameter validation of MGCP commands - text based encoding
- Parsing & validation of peer messages
- Reporting of peer entity failure
- Reliable transport

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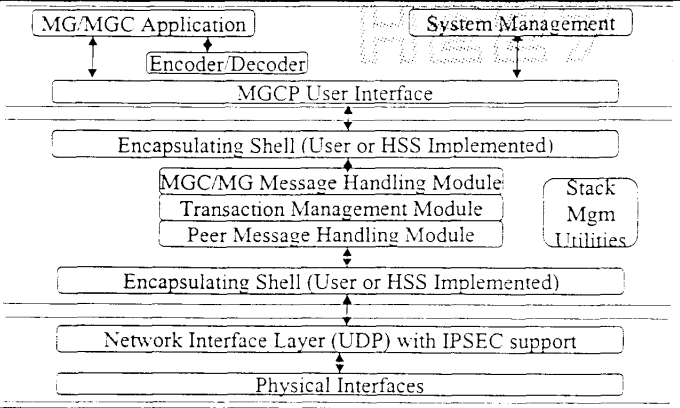
MGCP Stack Functional Block



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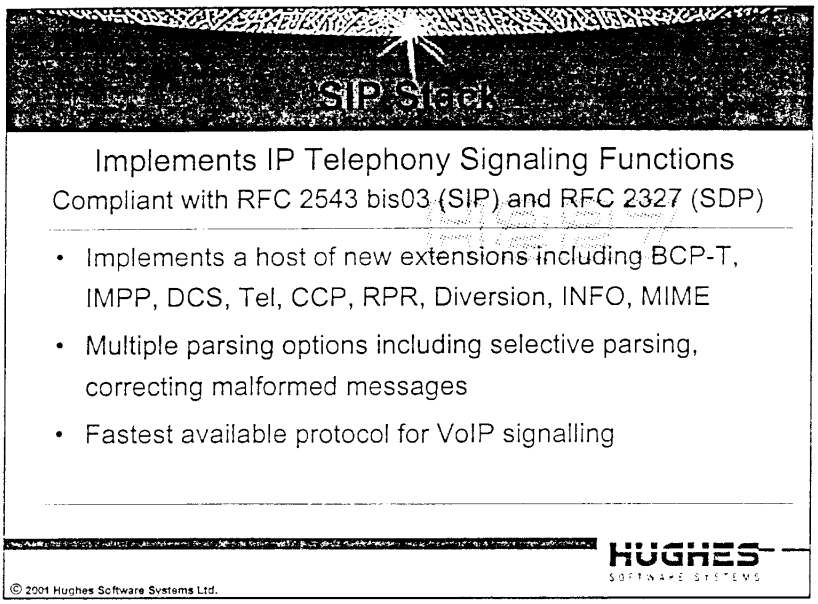
SIP Stack
Implements IP Telephony Signaling Functions
Compliant with RFC 2543 bis03 (SIP) and RFC 2327 (SDP)
• Implements a host of new extensions including BCP-T, IMPP, DCS, Tel, CCP, RPR, Diversion, INFO, MIME
• Multiple parsing options including selective parsing, correcting malformed messages
• Fastest available protocol for VoIP signalling
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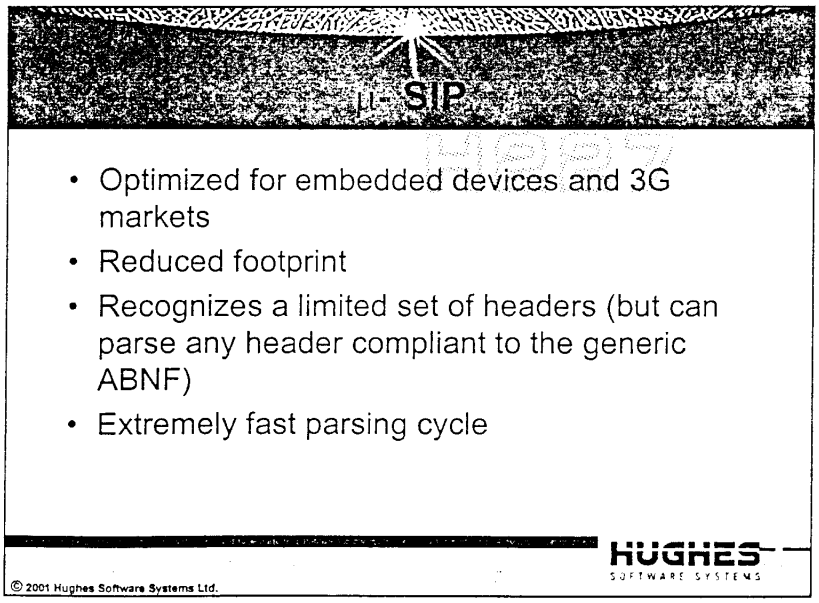
µ-SIP
• Optimized for embedded devices and 3G markets
• Reduced footprint
• Recognizes a limited set of headers (but can parse any header compliant to the generic ABNF)
• Extremely fast parsing cycle
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SIP User Agent

- Implements full SIP call state on behalf of the application
- Exposes simple to use call level APIs to the developer
- Handles automatic media negotiation and codec matching
- Handles mid call transactions
- can support multiple simultaneous calls
- can support multiple users using one instance

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SIGTRAN Stack

Implements SIGTRAN Protocol Suite

Conforms to current drafts for SCTP, M3UA, M2UA, IUA

- Enables transport of SCN signalling protocols over IP
- Reliable Signalling Transport over IP
- Encapsulation and Transport of SS7 and ISDN signalling protocols over SCTP
- Enables PSTN - PDN interworking and feature parity

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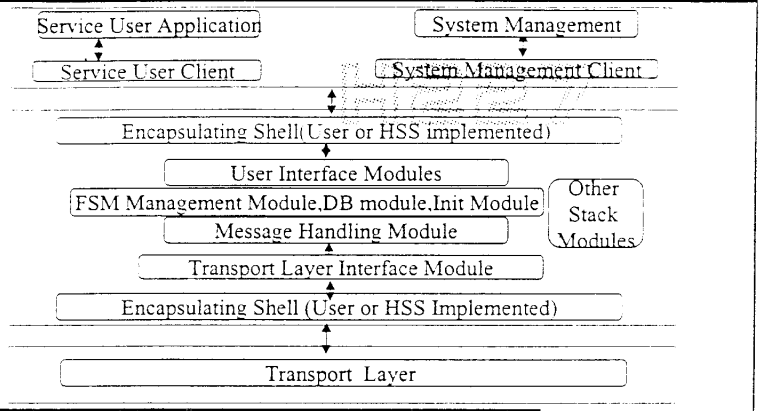
M3UA/SCTP Layer Functional Block



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H.323 Stack

Implements Signaling & Media Support Functions

Compliant with ITU-T standards

- H.245, H.225 (Q.931, RAS, RTP/RTCP)
- H.235 - Security
- H.450.X - Supplementary Services
- H.341 - Manageability

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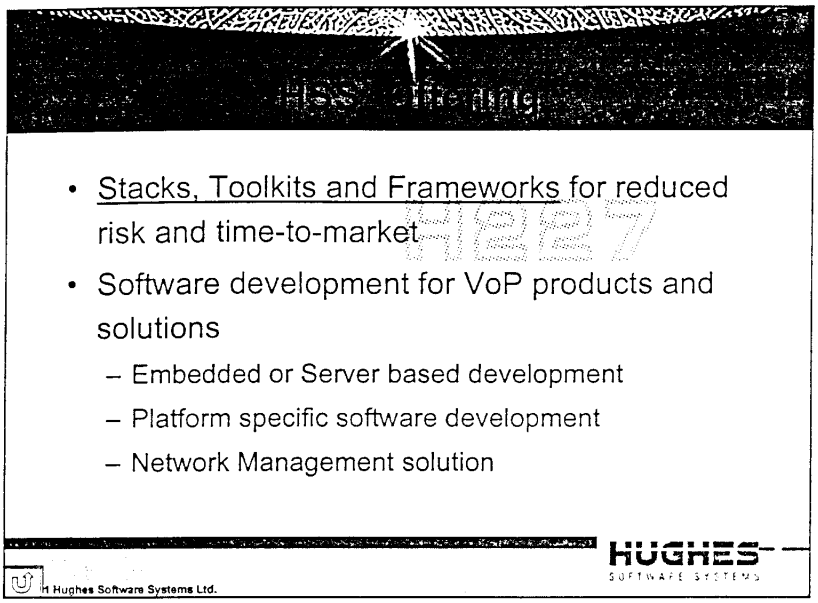
• Stacks, Toolkits and Frameworks for reduced risk and time-to-market
• Software development for VoP products and solutions
– Embedded or Server based development
– Platform specific software development
– Network Management solution
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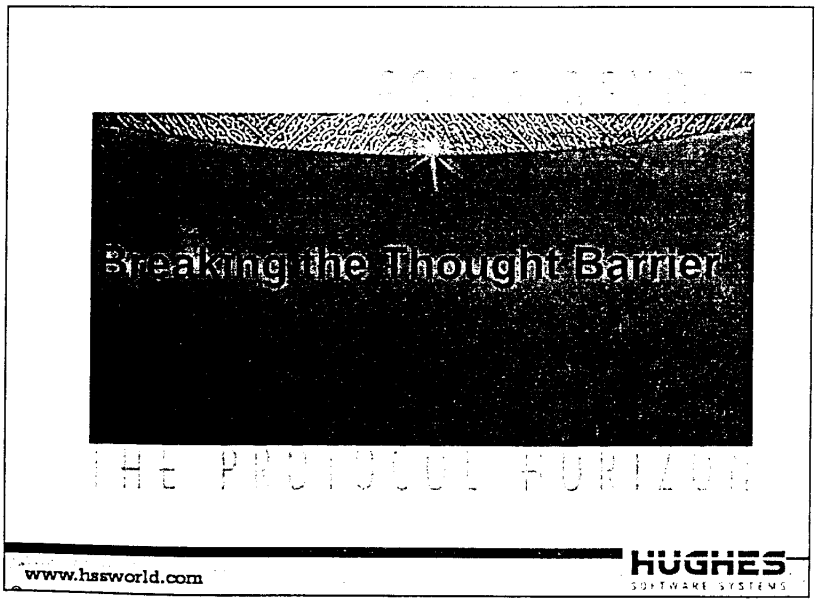
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