

# Presentation 2024



**Advanced Convergent CRM, Prepaid & Postpaid  
Billing, PCRF and RADIUS/Diameter Servers**



**Fiber, Wifi, ISP, Mobile, IoT, VOICE, 4G/LTE & 5G, IPTV & Wimax Providers**

# About Aradial Technologies

- Designer and provider of Billing, AAA and Policy control servers for all IP services.
- 20+ year of selling, in 80 countries and more than 1000 operators.
- Targets multiple vertical markets, Fiber,, Wifi, xDSL/FTTH, LTE, Voice, Cable, MNO/MVNO 2G/3G/4G/5G mobile, IPTV, WiMAX, IoT and Wifi offload.
- Experienced personnel from top networking and billing companies
- Private, self funded, profitable

# Aradial Products

- Aradial AAA/RADIUS
- Aradial Enforcer – AAA with Prepaid Enforcement
  - Spotngo add-on for Payment and top-up vouchers
- Aradial Converged Billing
  - CRM
  - Prepaid and Postpaid billing
  - Voucher management
  - Self Care and Captive Portal
  - Inventory, Workforce, Ticketing
  - PRM – Partner management including Hierarchies
  - Wholesale
  - PCRF – Policy Control Engine - module
  - Mobile 2G/3G/4G/5G support and IoT (Internet of things)
  - Diameter support for Gx/Gy/Gz and Ro/Rf – LTE
- PCRF– including AAA and optional billing
- HSS (including dual protocol Diameter and Radius)
- Aradial SMART-HLR - connector for 3G offload and Swx to HSS



# Key Customers

# ISP / WISP

- Kurdistan Network O3 – Fiber
- NewRoz Telecom – IRAQ
- Bezeq Israel ISP – Fiber, ADSL, Wifi, Wimax
- PMI – Philippe Morris – Enterprise
- Cable & Wireless Atlantic – broadband ISPs
- SurfNet, USA
- Jabbacom, USA
- DHI Telecom Group – USA, multiple locations
- Sure IO, deployment in multiple Islands
- MNBC – Mongolia
- Kewiko – Mongolia
- Nepal Telecom – xDSL, Dialup and Wimax
- Digicel group – Bermuda

# ISP / WISP

- Vodafone Ghana – Wifi Prepaid
- MTN Uganda – Wifi 3G offload
- MTN Rwanda – Wifi 3G offload
- Coopeguanacaste – Costa Rica
- NEPTUNO – Costa Rica
- Digicel group – Caribbean
- GTlink – Mexico
- Alma Telecom – USA
- Jefferson Telecom – USA
- Tnext - Canada
- ISOCEL – Benin – Fiber
- Partner Mobile – Nigeria
- ICON+ - Indonesia
- Gilat Satcom – Israel

# Mobile GSM/CDMA/4G

- **nPhase / Verizon Wireless**
  - 31M subscribers for supporting IoT and M2M
- Maingate / Sierra Telecom – M2M
  - 700,000 mobile subscribers in Sweden
- AireSpring – Multi MVNO deployment from USA
- L-Mobi, Netherlands – MVNO
- GTV – Greenland - LTE
- Somlink – MVNO and ISP
- Zamani Telecom – NIGER
- GECOMSA - Equatorial Guinea
- NSSL – UK
- Applied Satellite Technology– UK
- Sonatel - Orange Senegal – 300k+ users

# LTE

- Telrad - LTE and HSS with Telrad EPC
- Airspan - LTE and Wifi and Altran EPC
- Neragon
- YATE BTS
- Altran EPC
- Parallel Wireless
- ZTE
- Adax
- StarSolutions
- Athonet
- Druid
- JRC
- IP Look
- EU-CAST



# LTE - Deployment (partial)

- Safaricom
- Namibia Telecom
- Seaside USA
- Millennium Telecom
- WAW Senegal
- Togo Telecom
- Microcomm – Congo
- Afghan Telecom
- Africom
- Multitel – Angola
- Netpage – Gambia
- QCELL - Gambia
- Muni – EG

# LTE - Deployment (partial)

- IPX – EG
- Real Time (RT) Zambia
- Azqtel
- Iway Africa Kenya
- IPI9
- Comsys – Telesol
- Nepal Telecom
- Albidinet

# DPI

- Cambium QoE
- Preseem
- Allot
- Sandvine
- SAISE
- And others working with Radius or Diameter Gx

# WiMAX

- Telrad – including AeroMACS
  - NASA
  - China
  - Japan
  - More
- Airspan – multiple installations including LTE
- Cisco ASN-GW and Starent
- Huawei and ALU
- Cambium (Motorola PMP / Canopy Wimax)
- Runcom – multiple installations
- Wichorus/Tellabs

# Voice

- Most of the Mobile / LTE billing include 3G VOICE or VoLTE (supported)
- Net4India
  - VoIP provider with 2.5 M subscribers
- GCS - IDT
  - VoIP termination provider in USA
  - 100 million calls per month
- Globe Comm Systems

# Hotspots/WiFi Installed Base

Over 600 hotspots network installed worldwide

- Interstate USA
- DHI USA
- Jabbacom Wifi USA
- O'Fallon Wireless USA
- Telecell - Burkina Faso
- Easy Kiosk – Australia
- Tnext – Canada
- Avanti - UK
- MTN Rwanda - Balton/Alvarion
- MTN Uganda – Balton/Alvarion
- Dekal Telecom–Jamaica/Altai
- Noble Telecom - Jamaica
- Saudi Telecom - Altai
- Angola Telecom
- Namibia Telecom
- SurfNet USA



# Aradial Converged Billing

ARCB

# Aradial Converged Prepaid & Postpaid, Multi IP Services

- Prepaid and postpaid billing subscribers
- Multi-Play play services on same platform
- Advanced AAA & HSS- RADIUS and Diameter
- PCRF - Policy Control management
- Customer Management and basic CRM
- Voucher Management system
- Captive portal with responsive design
- Self care end customers
- Partner Management system (Resellers)
- Self care for Resellers
- Business Entities for Multitenant
- Balance transfers between subscribers and resellers for virtual payments/Mobile payments
- Advanced REST API to integrate with external system



# Aradial Converged Prepaid & Postpaid, Multi IP Services

- Customer Management Hierarchy
  - Account – shared balance for users
  - Users under account
  - Resource/ANI/CPE defined per users

\*Account can have a Parent account creating hierarchy
- Account and user operation
  - Role based for Admin types
  - View financial transactions, sessions and calls
  - Adjustments to invoices
  - Payment by credit card or PayPal
  - Manual payments – cash, checks, banks
  - Balance transfer between users and accounts

# Aradial Converged Prepaid & Postpaid, Multi IP Services

- Business Entity Management Hierarchy
- Business Partners and Reseller Management
  - Hierarchy
  - Revenue Sharing with Business partners
  - Registering subscribers / account
  - Selling vouchers and prepaid cards
  - Receiving commissions
  - Balance transfer (like Mobile Banking)
- Multiple VISP support as Business entity
  - Hierarchy
  - Special administration for VISP/BE
  - Manage users and vouchers under the VISP account
  - External HTTP interface for VISP billing integration
- Revenue Sharing with Business partners

# Aradial Converged Prepaid & Postpaid, Multi IP Services

- Captive portal (customized per location/SSID)
  - Responsive design—support all OS including phones
  - Self registration - template
  - SMS registration (sending PIN via SMS) - template
  - Free registration (e.g. limit 30 min per day)
  - Buying online by PayPal / CC
  - Voucher registration and refill / top-up
- Self care for users and accounts
  - Users and passwords management
  - Accounts - Payments and invoices
  - Purchase new offers and upgrades
  - View usage and sessions
- Trouble ticketing

# Aradial Converged Prepaid & Postpaid, Multi IP Services

- Product catalog
  - Price plans
  - Offers using price plans
    - Price plan
    - Network profile provisioning
  - Additional offers – enhances an offer
  - One-time offers
  - Add on offers – e.g. for defining top-up products

# Aradial Converged Prepaid & Postpaid, Multi IP Services

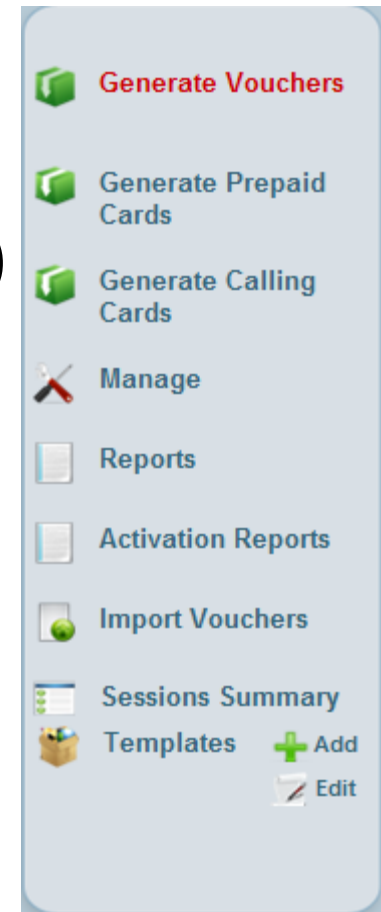
- Flexible charging & rating
  - Periodic Recurring Charges
  - Usage charges
    - Flat rate
    - Pay as you go
    - Allowances – multiple balances and counters
    - Time of day and day of week and Calendar dates
    - Destination charging – e.g. use for VOIP and VOICE Prefix table
    - Cost determination for wholesale
    - Charging for movies and video on demand
  - One-time charges
  - Custom rate plans per customer requirement

# Aradial Converged Voucher management

- Voucher management
  - Top-up vouchers
  - Prepaid Cards - Activated on first use
  - Calling Cards
- Creating in Batches
- Generating and managing by Resellers/Business entity (self care for BE)
- Voucher reports including Revenue reports
- Vouchers used in Captive Portal and Self Care
- Advanced Life Cycle including export to files
  - Created
  - Shipped
  - Ready for use
  - In use

# Vouchers

- 3 kind of Vouchers:
  - Top-up Vouchers
  - Prepaid Cards (Anonymous user)
  - Calling Cards (VOIP)
- Reports
- Templates
- Manage vouchers



# Aradial Converged Prepaid & Postpaid, Multi IP Services

- Invoicing
  - Periodic automatic invoicing
  - Invoicing sent by email
  - XSL layout – branding
  - Undo billing
  - Discounting
- Accounting reports
  - Invoicing
  - Payment
  - Operator statement, per-account statement
  - Aging payment



# Aradial Converged Prepaid & Postpaid, Multi IP Services

- Automatic payment
  - Error management
- Account Receivables (A/R)
  - Manual entered payment, fast payment screen
  - Multiple Credit card payment gateways
  - PayPal
  - Bank Transfer (\*)
  - Mobile Payments (\*)
- PMS – Micros (Fidelio/Opera support)

# Aradial Converged Billing CRM features

- 360 View of customers
- Trouble Ticketing
- Inventory and Resource management
  - SIM
  - MAC Address
  - IP Address
  - ANI
  - DID
- Workforce management
- IP Monitoring
- CDRs processing & error management or rating problems

# Aradial Converged Billing Mediation and Provisioning

- Radius server
- Diameter Server – Gx/Gy/Cx/Rx/SWx
- CDRs processing & error management or rating problems
- Provisioning from PCRF and scripts
- Notifications via SMS/Emails using Templates

# Aradial Policy Control

- PCRF - Policy Control quota management
- Fast definition of Policy rules, actions and step
- Handles various users events
- Advanced dynamic policies for active users
  - Fair usage
  - Change of QoS parameters in real-time
  - Disconnect
  - Redirect
  - Send notifications via email and SMS

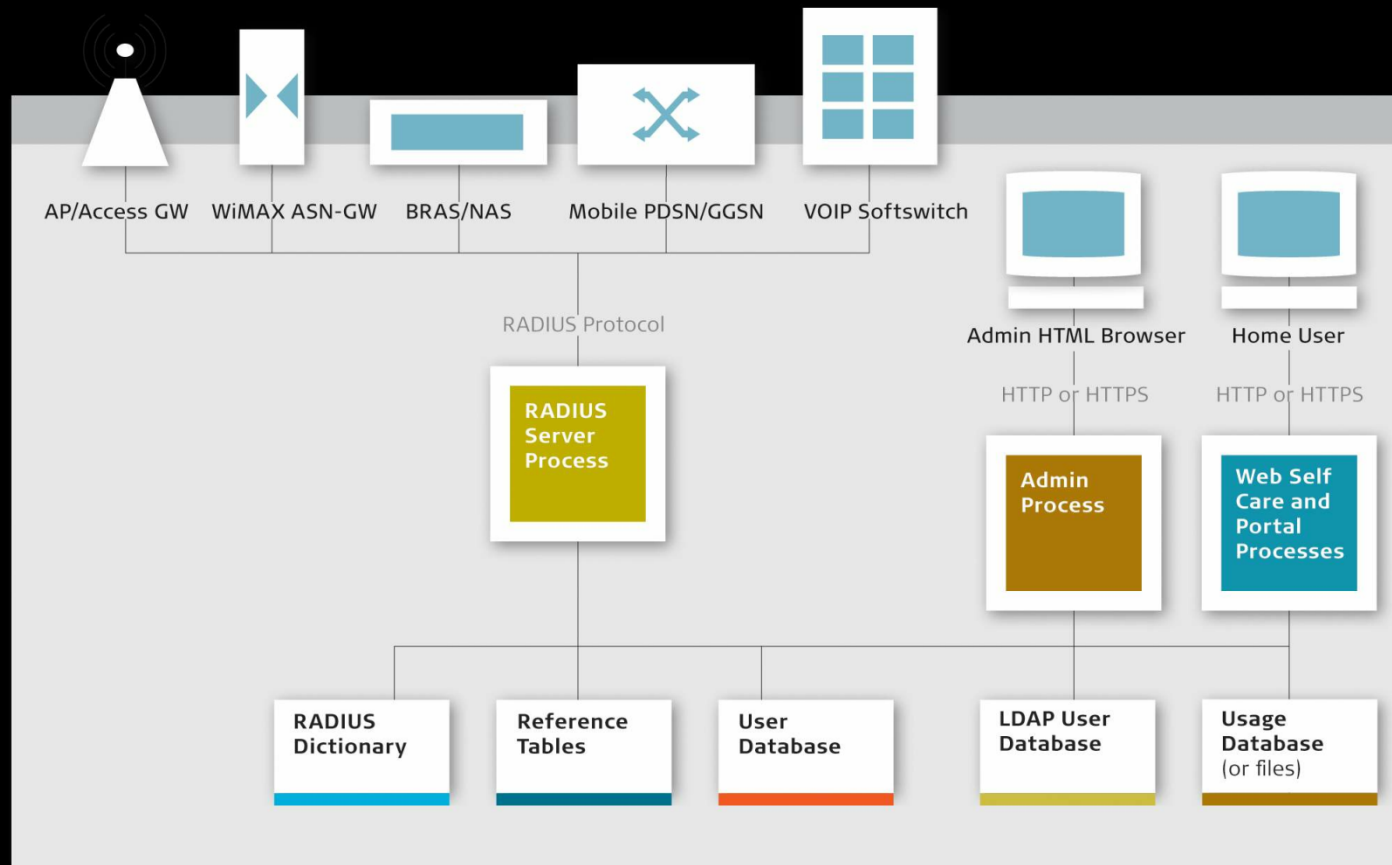
# Wifi / Hotspots Advanced Features

- Bandwidth and QOS per unique NAS
- Volume quota limiting
  - Using RADIUS attributes sent to the NAS
  - Using Interim updates and COA / POD
  - Exact volume charging without Interim accounting, using redirection with Runcom.
- Time bank / allowance
- Expiration
- POD - Packet-of-disconnect for live sessions
  - From the Admin
  - Using API from external system
- COA – change of Authorization

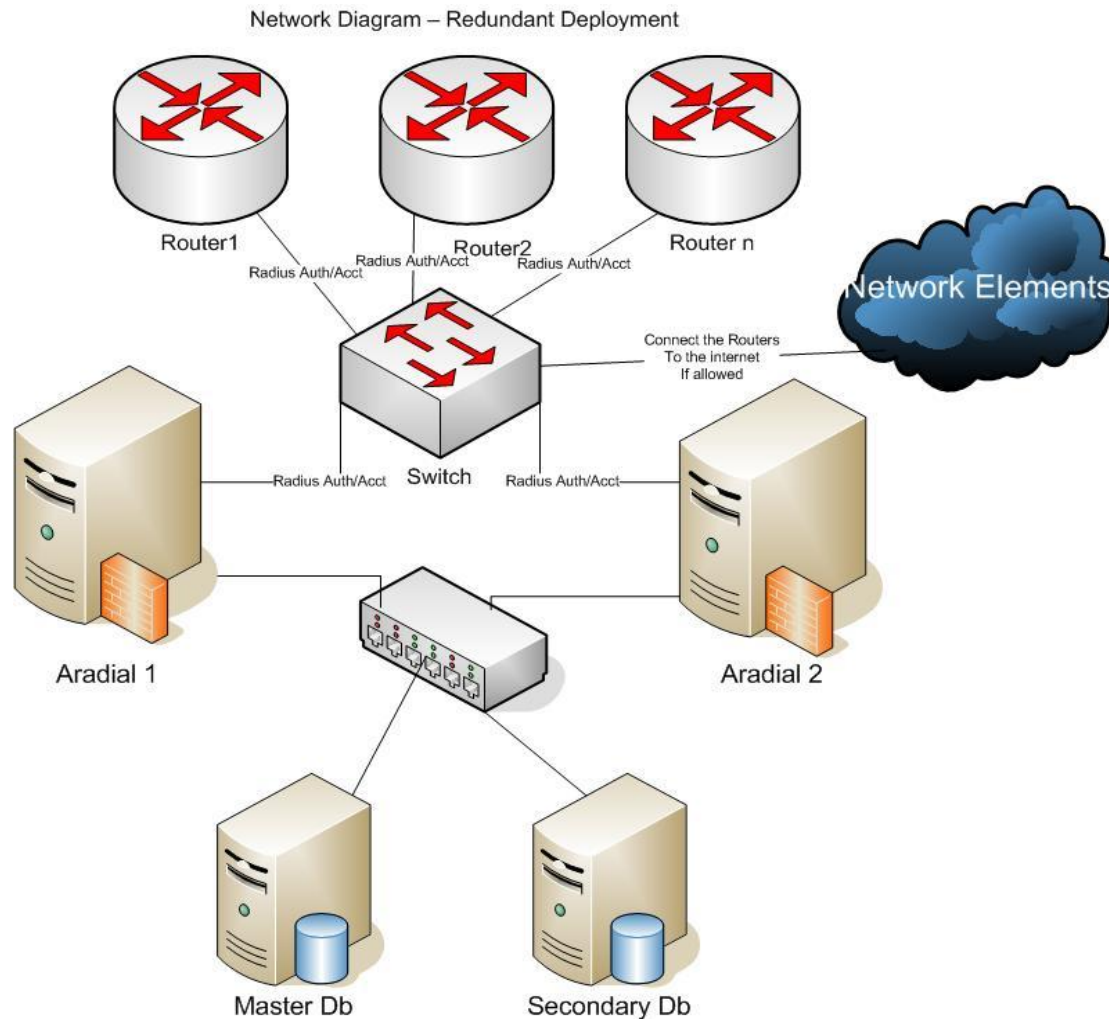
# Wifi / Hotspots Advanced Features

- Different Portal per location or VLAN
- Different catalog/cart per location
- Doing MAC authentication prior to redirecting to web page.
- SMS and USSD registration flow - template
- Time Period charging and bandwidth
- Location/SSID based charging

# Architecture



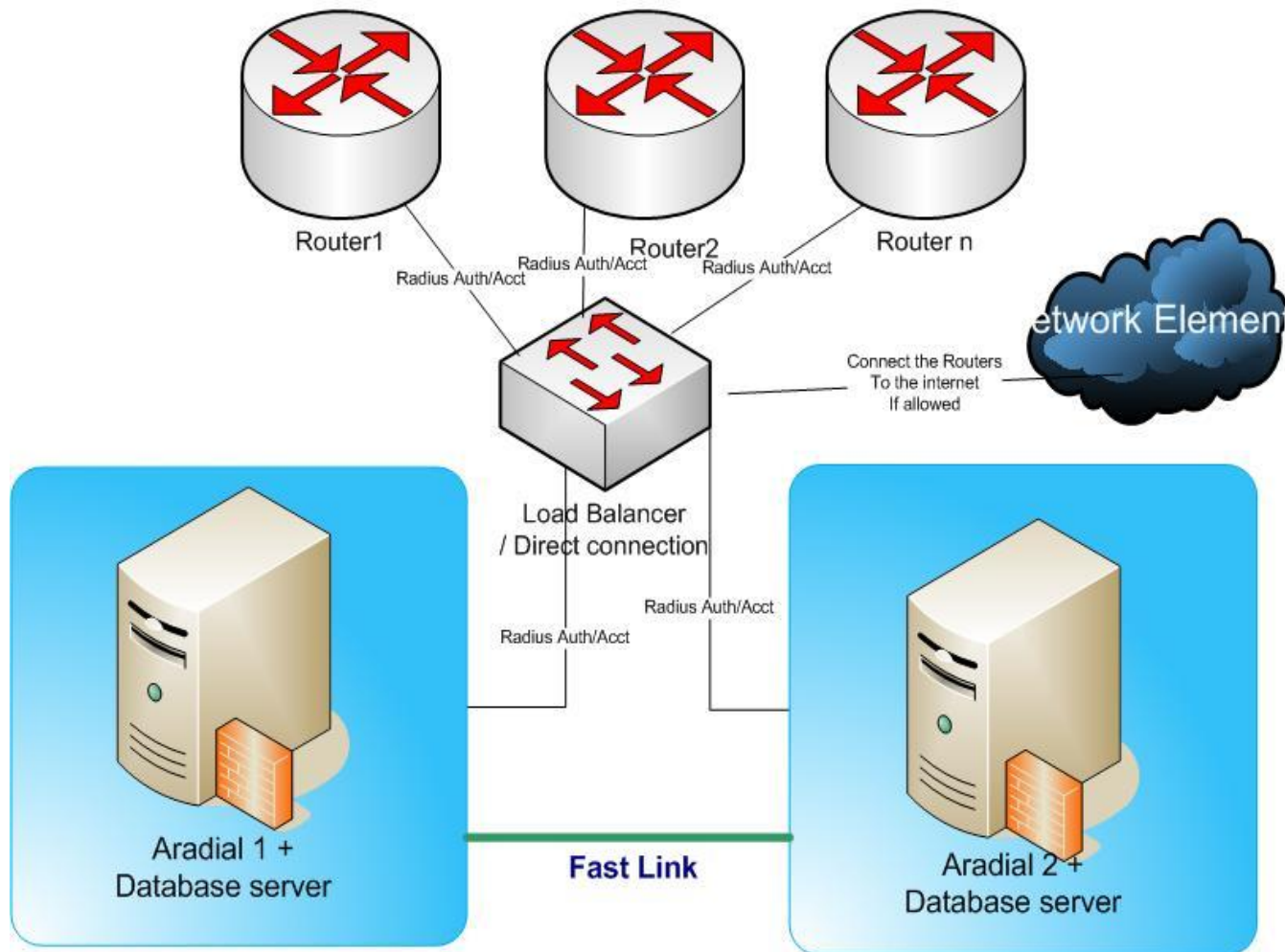
# Typical High-Availability Deployment





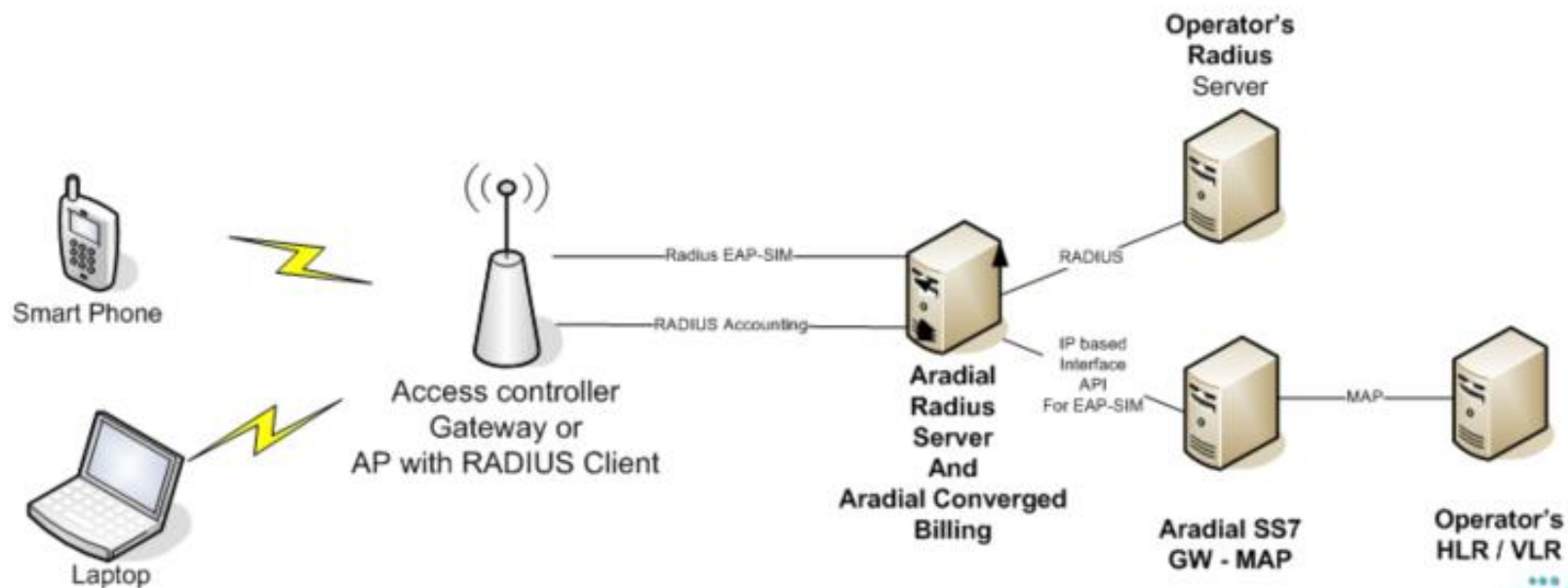
# Possible GEO/DRP Deployment

Network Diagram – DRP Deployment – Database on same machine



# Integration using Aradial Smart-HLR Gateway

Aradial EAP-SIM Mobile Offloading using Aradial SS7 MAP - HLR Gateway





# Aradial LTE

# LTE & AAA and Billing

- LTE Billing and policy control
- Prepaid and postpaid
- Diameter standard for Gx/Gy/Gz for PCRF
- Diameter Ro/Rf/Gz for charging
- Client for Wifi offloading – Diameter Swx
- HSS – Diameter based
- HSS & AAA supports LTE extension for HSS
- Radius to Diameter converter



# Aradial WiMAX

# WiMAX AAA/Radius and Billing

- WiMAX Forum standard compliant
- AAA supports 16e NWG 1.4 Stage 3 including:
  - Authentication and authorization
  - EAP-TTLS/TLS for authentication adapted to the WiMAX standard
  - Integration with leading ASN gateway partners
  - IP-based and flow-based accounting
  - Hotlining with CoA
  - Wimax Prepaid application
  - 16d support with all known BRAS

# WiMAX AAA/Radius and Billing (Cont.)

- Real-time active session management
- Scalability and real-time AAA functionalities
- Cost-effective solution and fast ROI
  - Billing and ordering:
    - All services, including broadband data, VoIP, voice, IPTV, VoD for WiMAX
    - Allows controlling users balance, time and traffic in real time and with zero leakage
- Advanced user management for subscribers
- Advance creation of prepaid cards
- Self ordering and provisioning redirection to activation portal at zero balance and plans purchase (add on module or ARCB billing)

# WiMAX AAA/Radius and Billing (Cont.)

- Integration with external billing systems and future systems - advanced APIs for external billing integration, for both real-time events and provisioning
- Support of the following base station providers: Airspan, Telrad/Alvarion, Cambium/Motorola PMP, Huawei, Alcatel Lucent, Ipaxiom, Soma, Samsung, Redline, Aperto, Expedience, Runcom





# Enforcer - Aradial RADIUS & AAA Server

# Aradial AAA Server/ Module

- High performance, fully-featured
- Compliant with RADIUS standards
- EAP support including EAP-SIM/AKA
- Wimax NWG support and LTE extension
- IPv4 and IPv6
- Scalable and High available  
(Multithreaded, Multi process)
- Geo redundancy
- Provisioning interface exposed to External system
- Diameter AAA and HSS - extra optional module
  - Diameter – Ro/Rf (DCCA), Gx/Gy (PCRF), SWx

# Aradial AAA Server (Cont.)

- 100% web-based interface
- Web User management
- Web Role based user interface
- Group - Policies for group of users
- SSL security support
- Scalable Dynamic IP Pools
- Databases
  - MS SQL, Oracle, MySQL, LDAP, Active Directory
- Concurrency management - Online sessions
- Statistics and reporting modules
- REST API for external application

# Aradial AAA Server (Cont.)

- Enforcer add-on module:
  - Prepaid cards management
  - Volume, Time and expiration enforcement
  - Bandwidth management
  - Disconnect using PoD on quota depletion
  - MAC authentication and binding



# Spotngo Payment Module Add-on to Enforcer

# Spotngo Enhanced Vouchers and Credit-Card Payment Module

- Plan/tariff management (time, traffic and expiration)
- PIN generation and management using plans
- User signup from the portal using a PIN
- Refilling users with a new PIN (PIN attached to a tariff plan with time, traffic or expiration)
- Refill by credit card
- Creating users with a credit card
- Configurable and customizable payment interface
- View/query payment history
- Secured portal (SSL)
- Secured PIN and plans management (SSL)
- Printing and exporting PINs to CSV files
- Customizable flows



# Aradial Prepaid VoIP

# Prepaid VoIP with Aradial

- Aradial VoIP supported services:
  - IVR calling
  - Direct calling using ANI/calling cards
  - Username
  - Peering
  - Termination and origination
- Two charging models:
  - Single session – entire balance is allocated for the user during the session
  - Multisession – the session is split into time quotas for all users that use a single balance



# Prepaid VoIP with Aradial (Cont.)

- Centralized authentication and accounting for all routers or gateways
- High-performance and reliable server
- Scalable to handle millions of users and concurrent sessions on low-end hardware  
Converged IP services
- SSL secured HTML-based administration
- Dealer/business partner management – dealers can manage their own users
- Extended HTML UI for user database and user groups

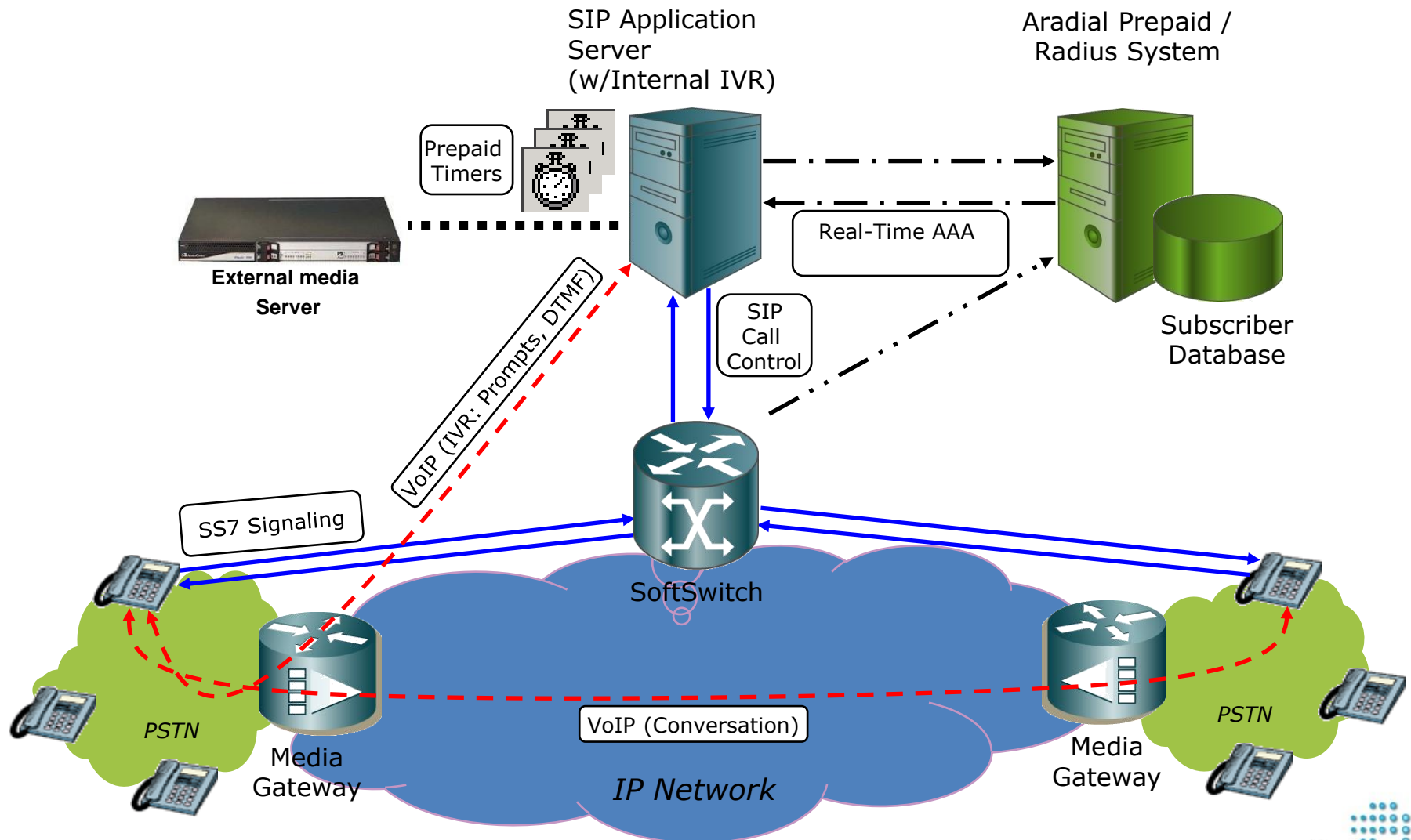
# Prepaid VoIP with Aradial (Cont.)

- Self-care user module
- User and calling-card management, rating, import and export from/to CSV files
- Balance, duration and traffic enforcement
- User concurrence enforcement and view of concurrent calls from the administration tool
- Optional integration with SNMP-based NMS
- Multiple admin types
- Admin activity tracking
- External billing system interface using stored procedures or CORBA

# Prepaid VoIP & Calling Cards

- Calling-card based prepaid billing
- Calling-card generation, import and export
- Username or ANI based (caller ID) prepaid VoIP billing
- Rating according to call destination, time of day, day of week
- Different rounding intervals per tariff or per destination
- Call setup cost
- Replenishing API or voucher refilling with payment module.
- Support of multiple tariffs and destinations rating tables that can be assigned to a calling card
- Session and summary reports per calling card, system, destination and period
- Optional module – termination billing including wholesale credit limit and fraud control

# Architecture





# Supported Services and Equipment vendors

# Aradial Supported IP Services

- Any broadband, BRAS, xDSL or cable
- LTE 4G
- Mobile
  - GSM: GPRS, WAP, MMS
  - CDMA 2000 and 3GPP dictionaries
  - PDSN 3GPP prepaid and postpaid
- IoT
- Wireless LAN
- 3G Wifi Offloading
- WiMAX – WiMAX forum standard
- Wide Area Wireless base stations
- Mesh technologies

# Aradial Supported BRAS/GPON and PCEF

- Cisco all models including PDSN
- Redback SmartEdge
- Juniper ERX and JRX
- Alcatel
- Huawei
- ZTE
- Meraki
- Runcom SG-BA and SG-1
- Others

# LTE

- Telrad - LTE and HSS with Telrad EPC
- Airspan - LTE and Wifi and Aricent EPC
- Cello Wireless / Neragon
- Parallel Wireless
- ZTE
- Adax
- StarSolutions



# Aradial Supported Wide Area Base stations

- Ruckus
- Huawei
- Alvarion Networks (WBS/Wavion)
- GoNet
- Altai Technologies
- Motorola Solutions WING
- Cisco WLC
- Ubiquity
- Aruba
- Autelan
- Motorola Canopy - Cambium
- Xirrus

# Aradial Supported WiFi Access Controllers

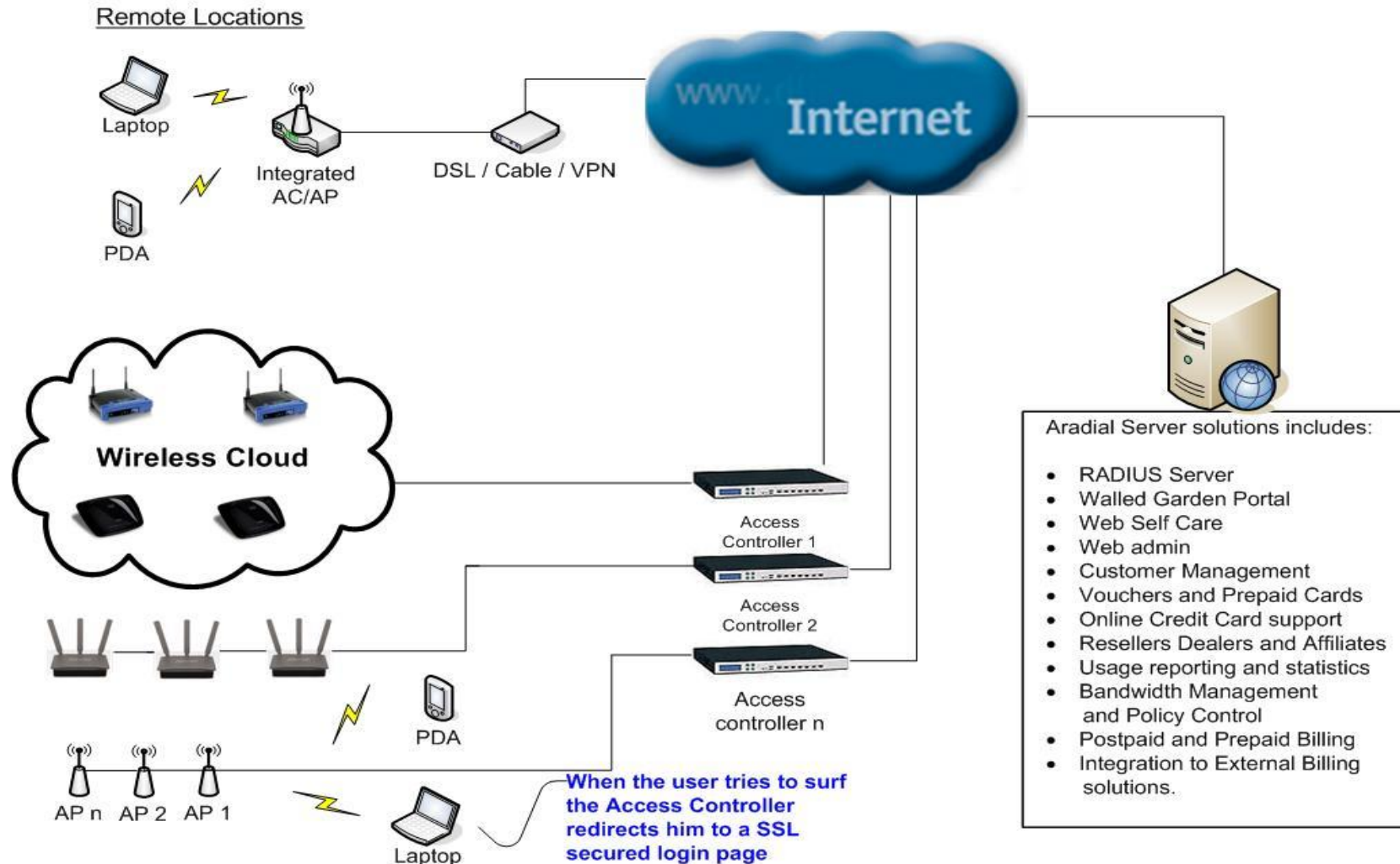
- Ruckus (vSCG, Zone Director, etc)
- Huawei AC
- Mikrotik OS
- Cisco WLC
- Motorola WING
- Aruba Networks
- Nomadix
- HP Curve
- Zyxel, ValuePoint, Planet, Handlink
- 4IPNet
- Griffin, Dlink, NetGear
- Chillispot based, Linksys - DD-WRT
- PfSense
- Ikarus OS
- Runcom SG1

# WiMAX

- Huawei and ALU
- Airspan
- Telrad / Alvarion
- Cisco Starent
- Runcom
- Wichorus/Tellabs
- Cambium / Motorola PMP / Canopy Wimax
- Samsung – IOT
- Getek - IOT
- Others that support NWG 1.3 and above

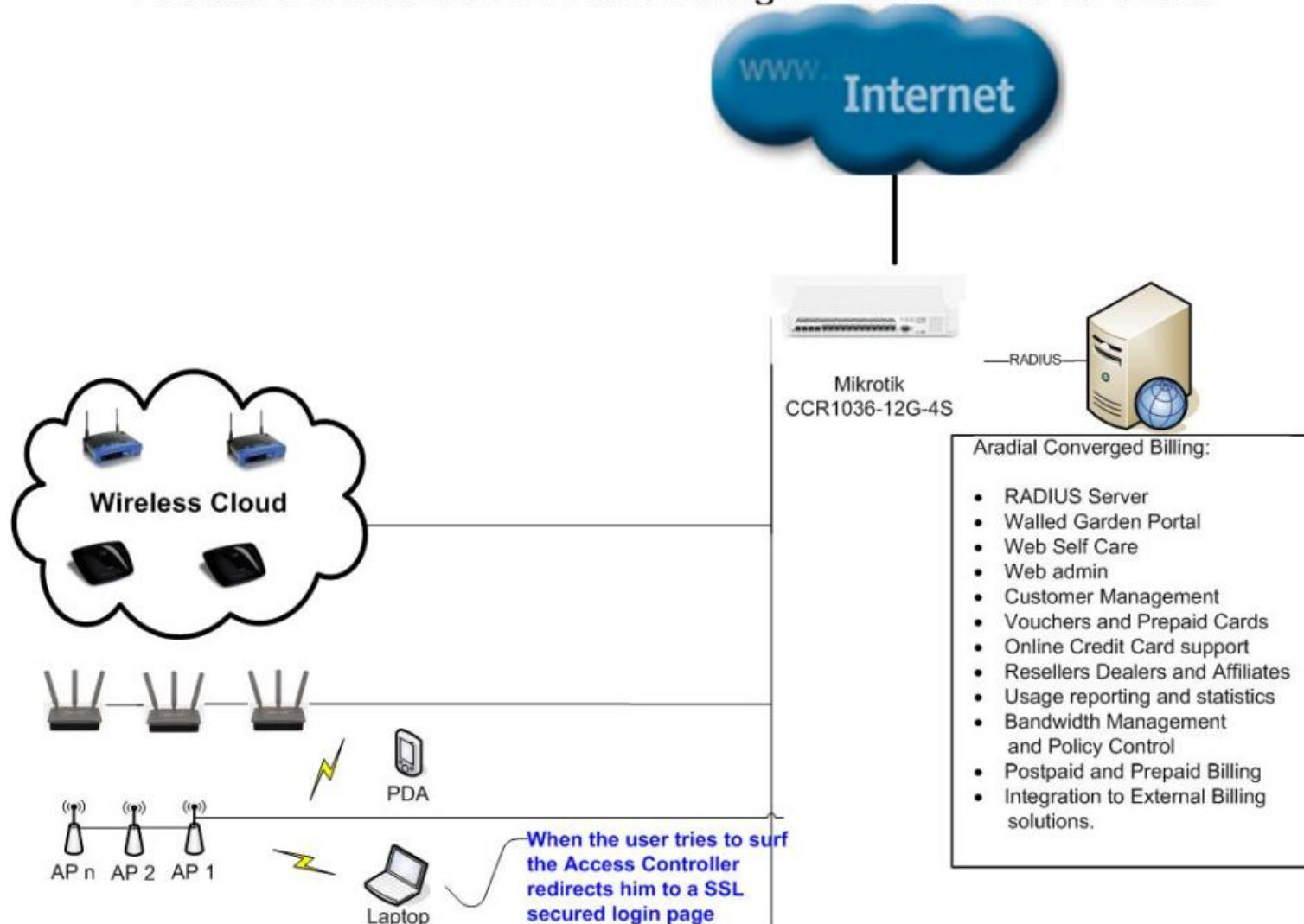
# Typical Hotspot Deployment

## Aradial Centralized AAA and Billing for Wireless LAN Users



# Centralized deployment

## Aradial Centralized AAA and Billing for Wireless LAN Users



# Aradial Supported IP Services (Cont.)

- Soft switches and SIP proxy (Class 4/5)
  - YATE
  - Cisco
  - Teles
  - AudioCodes
  - Mailvision
  - RAD
  - NextGK
  - VocalTec
  - Asterisk
  - Any other that supports standard SIP VSA
- VOIP gateways
  - Cisco 53xx, 54xx,
  - Quintum Tenor
  - GNUGK and OpenSer
- IPTV using RADIUS



# AAA & Enforcer Advanced Features

# Overview

- Policy algorithms
  - Handling RADIUS messages
- State server
  - What is happening in the network
- Prepaid user monitoring
- User management
- Process monitoring
  - Including SNMP MIBs and traps
- Load simulator to test the network
  - Test any scenario for any equipment



# Policy Algorithm Mechanism

- Customizable handling flow for each RADIUS message type
- Flow made of a chain of RADIUS algorithms
- Core algorithms supplied with the product
  - Authentication and Authorization algorithm
  - Accounting algorithms
  - RADIUS proxy algorithm
- New algorithms can be developed using shared C++ and/or LUA & TCL scripting

# Aradial AAA Features

- PAP and CHAP authentication
- EAP authentication
  - EAP-PEAP, MD5, LEAP
  - EAP-TTLS, TLS
  - EAP-SIM and AKA (need integration with HLR and/or HSS)
- Digest, MS-Chap and MS-ChapV2
- Proxying to other RADIUS servers
  - RFC-based RADIUS proxy
  - Boingo, iPass & other specialized proxy support
- Tunneling :PPTP, L2TP
- Policy algorithms

# Unique Functionality (Cont.)

- User management with roles
- Prepaid cards management
- Captive portal
  - Responsive design for Mobile Smartphone and laptops
  - Customization of the portal per location
- Self care
- Bandwidth management
- Quotas and balance enforcement and expiration
- Disconnect using PoD on quota depletion
- MAC authentication and binding
- Viewing sessions and summaries
- Exporting usage
- Importing users and managing changes from files

# Unique Functionality

- LUA & TCL scripting for policy algorithms
- Extended billing server connectivity API
- Grouping and subgrouping
- Persistent IP pools (support H/A)
- Bandwidth control per NAS model
- Metering (on external billing databases)
  - Time and data accumulator
  - Service suspension based on traffic per NAS model
- Blocking or changing QoS for groups in time-of-day periods (for example, peak, offpeak configurations)
- POD and CoA support

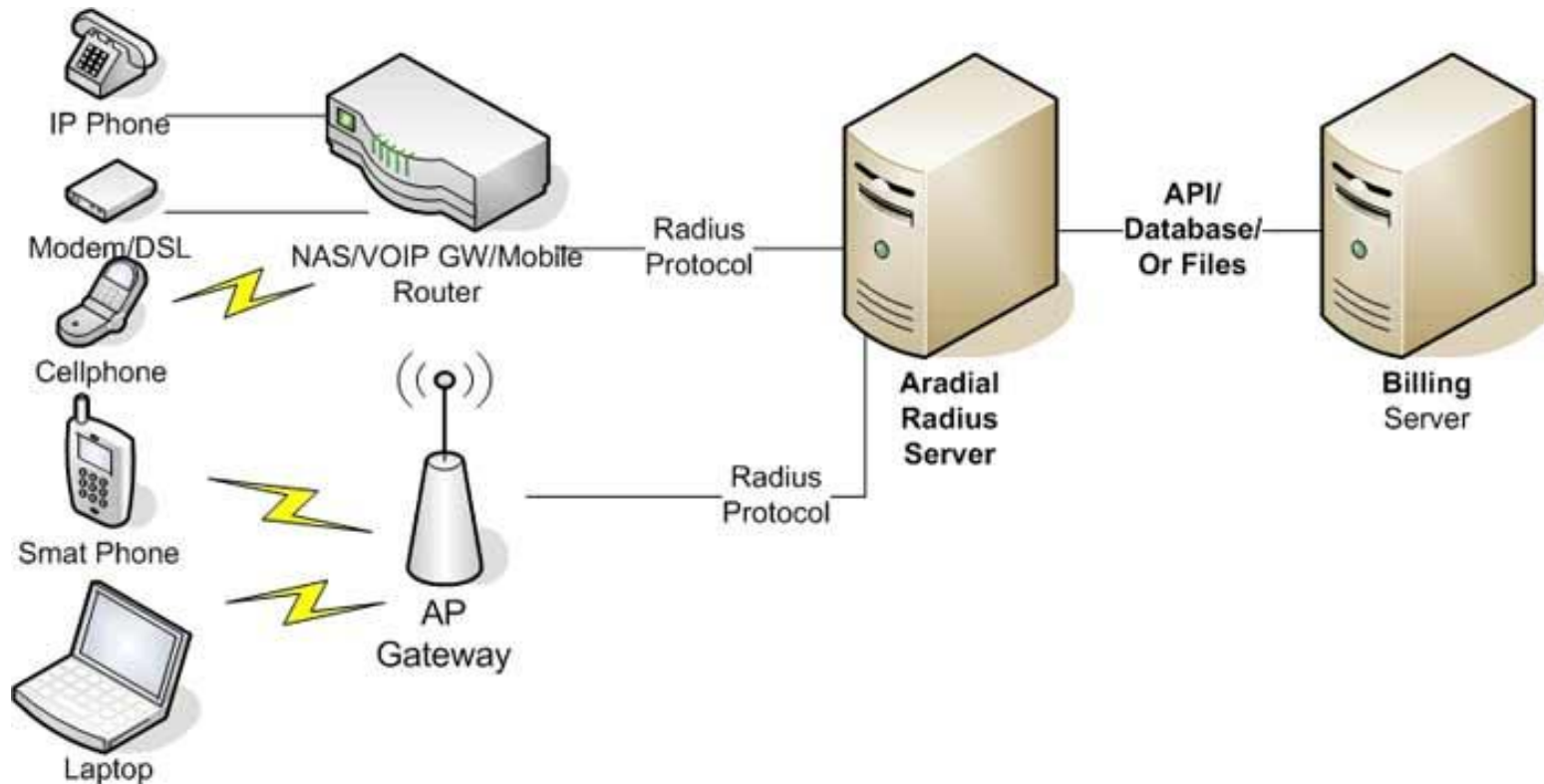
# Unique Functionality (Cont.)

- Spotngo payment system
  - Refillable vouchers
  - Credit-card processing
  - PayPal support
  - Customization of Spotngo per location
  - PMS system support – Fidelio/Micros

# Integration with External Billing Systems

- Advanced API for external online charging/billing servers
  - Session duration limitation
  - Data transfer limitations – directional limiting supported
  - Bandwidth limit using VSA RADIUS Attributes
  - Quota-based access
  - QoS and subscriber profile
- Integration using Diameter Ro/Rf/Gy
- Integration using stored procedures calling external databases
- Export usage to billing systems
- Enhanced provisioning APIs
- Internal support for traffic, duration metering & QoS

# Typical Deployment Example





**Thank You.**

**[www.aradial.com](http://www.aradial.com)**