



Cisco Service Provider Voice Solutions Update

BRKBBA-3009



George Bell
Mark Rankin

Cisco Networkers
2007

HOUSEKEEPING

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- Please remember this is a 'No Smoking' venue!
- Please switch off your mobile phones!
- Please remember to wear your badge at all times including the Party!
- Do you have a question? Feel free to ask them during the Q&A section or write your question on the Question form given to you and hand it to the Room Monitor when you see them holding up the Q&A sign.

Abstract

This session provides an update of Cisco's voice solutions for service providers, including those for residential and managed business voice applications.

This session covers Cisco's SP Voice solutions for residential and managed business voice applications, including coverage of high-level architecture, components, updates for the relevant platforms and examples of network designs to offer these services.

Agenda

- Cisco Consumer Voice Solutions (George)
 - Overview of Consumer Voice solution (architecture and infrastructure elements)
 - Design Considerations
- Cisco Hosted & Managed Voice Solutions (Mark)
 - Introduction to BVS & HUCS
 - HUCS Architecture & Key Concepts
 - Case Studies
- Q&A



Consumer Voice Solutions Update



George Bell

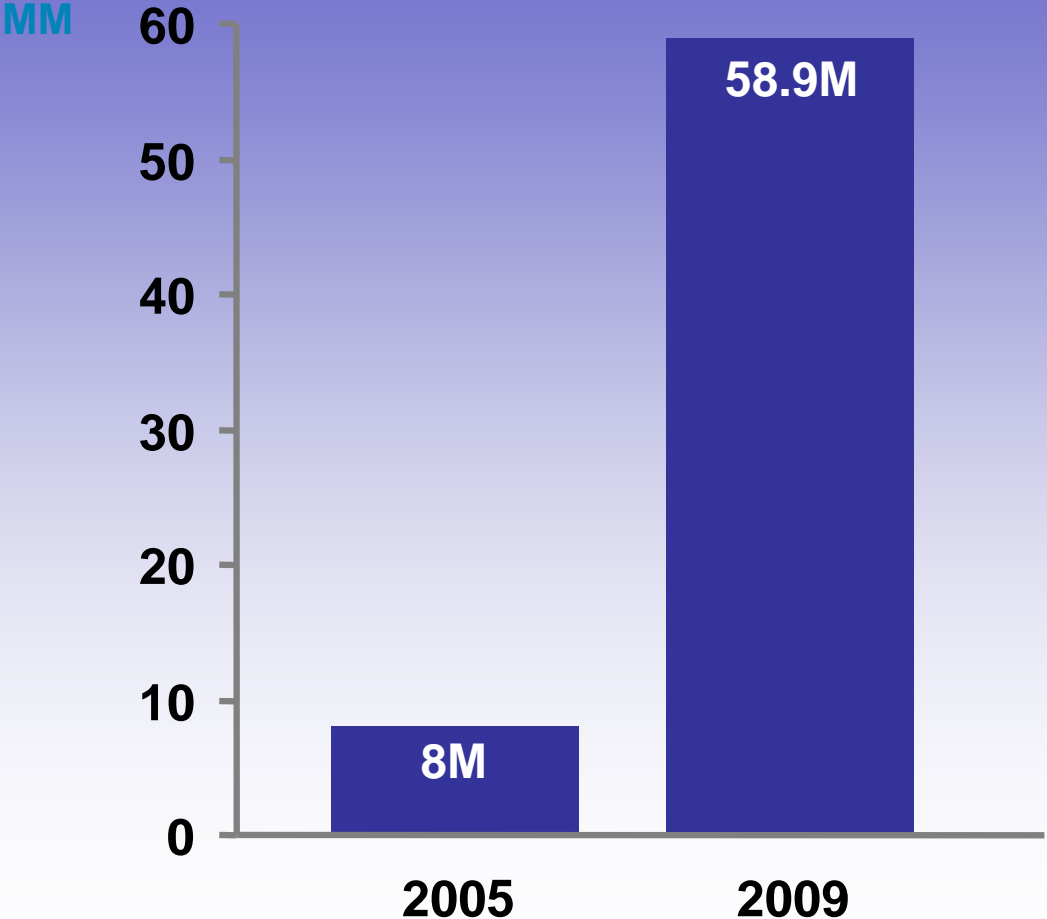
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Consumer Voice Architecture and Infrastructure Components



Broadband VoIP Users- accelerated growth

Worldwide VoIP Users Making Phone Calls Over Broadband Connections

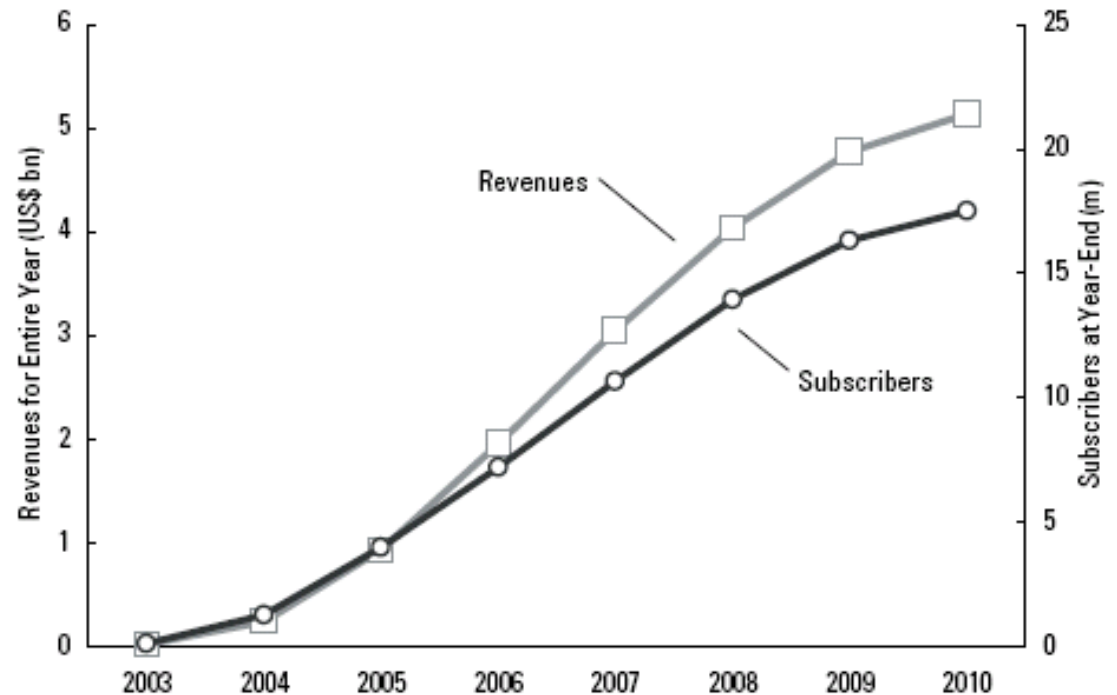


Synergy Research Group, March 2005



Projected Consumer VoIP Revenues and Subscribers (US and Europe)

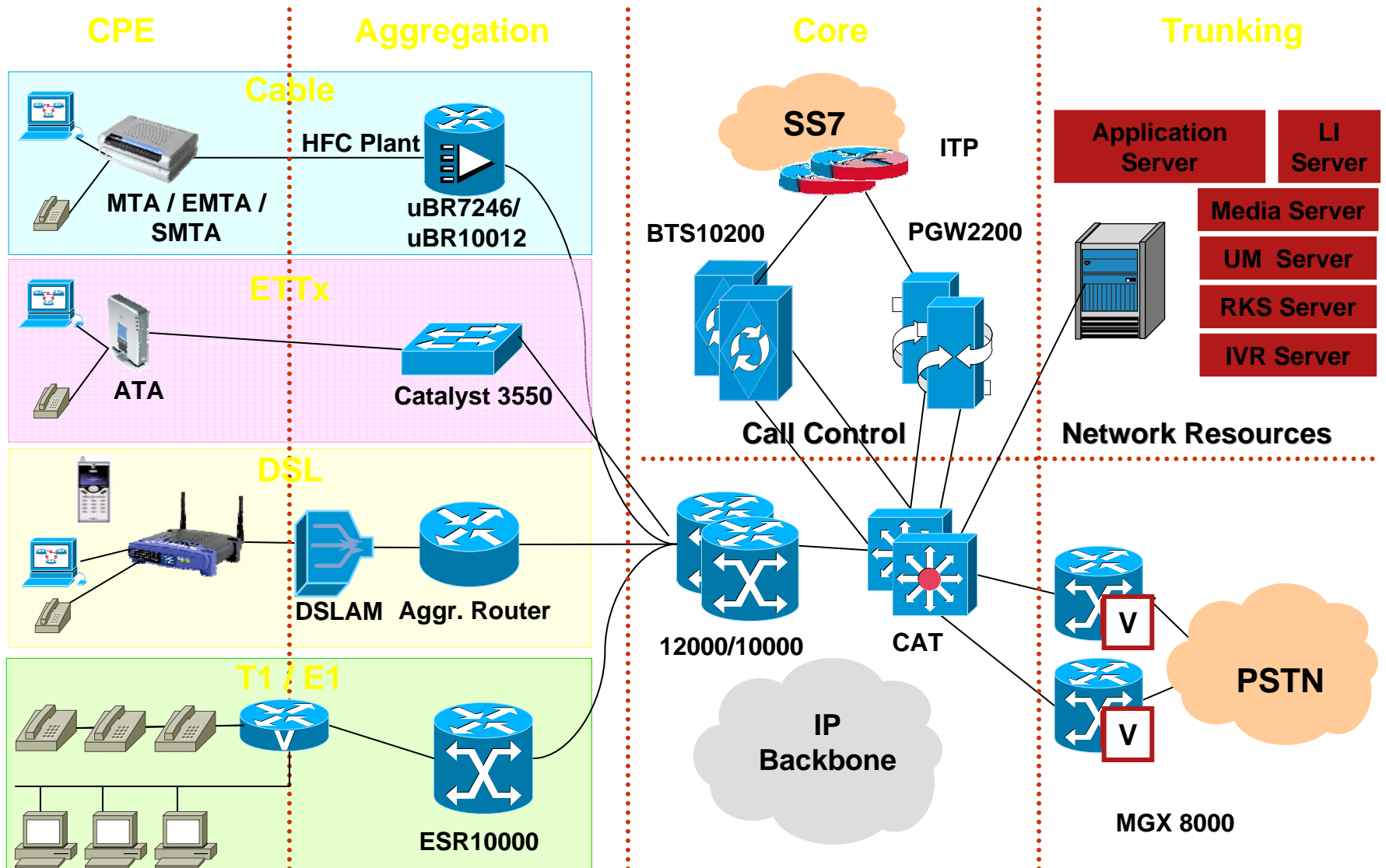
US Market projection, 2003-2010
(source: Telegeography, 2005)



European VoIP market projection: from 2.2 M subscribers (2004) to 27.8 M subscribers (2008)
(Infonetics Research)

Cisco Consumer Voice Solutions

Access-Agnostic Broadband VoIP (Residential & Business)



Voice Infrastructure components

- Cisco PGW 2200 (PSTN Gateway)
- Cisco BTS 10200 (Softswitch)
- Trunk gateways (AS 5000 series, MGX)
- Session Border Controllers

Cisco SP voice infrastructure elements

- Different solution architectures to match service provider and consumer requirements – many combinations of these and third-party elements are possible depending on requirements
- Voice infrastructure elements are part of a solution package – tight integration with other applications/ services and existing infrastructure yields maximum benefit to the service provider

Cisco PSTN Gateway Solutions—PGW 2200

Programmable Element Enabling:

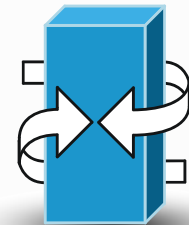
- Supports ISUP, PRI, H.323 and SIP interfaces for interworking between networks
- Hides complexity of PSTN from IP telephony devices and applications
- Enables multiple Carrier Services (Voice Transit, Dial Access, ASP Termination) and Managed Business Voice (Hosted IP Telephony, Voice VPNs)

Delivering:

- Scalable, centralized call control and billing
- Advanced routing capabilities and circuit selection supporting regional regulatory requirements
- An SS7 Trunking Gateway to networks that have existing R2 and PRI based gateways

Cisco PGW 2200 PSTN Gateway

Providing a Bridge Between
PSTN and IP Networks



PGW – enhancements in current software releases (9.5/9.6)

- INAP CS1 enhancements
- DPNSS, QSIG PBX support
- CCM interworking (H.323), Unity interworking (SIP)
- AOC generation over ETSI PRI
- Enhancements to SIP-H.323 interworking
- SIP Privacy enhancements (P-Asserted and Remote Party ID headers)
- SIP Multiple address in Contact Header
- SIP Load Sharing using SRV

Further enhancements in PGW with release 9.7(3)

- New hardware platforms supported (Sun Opteron platforms)
- Solaris 10 as operating system
- Higher performance
- FlexLM licensing
- SIP B2BUA enhancements

Cisco Softswitch Solutions—BTS 10200

Programmable Element Enabling:

- Supports local access methods, including ISUP, PRI, IAD, cable modem, PBX, for cost-effective last mile access alternatives
- Complete set of local voice service features for business/residential users
- Use today's VoIP infrastructure to create one network for voice/data services, and video in the future

Delivering:

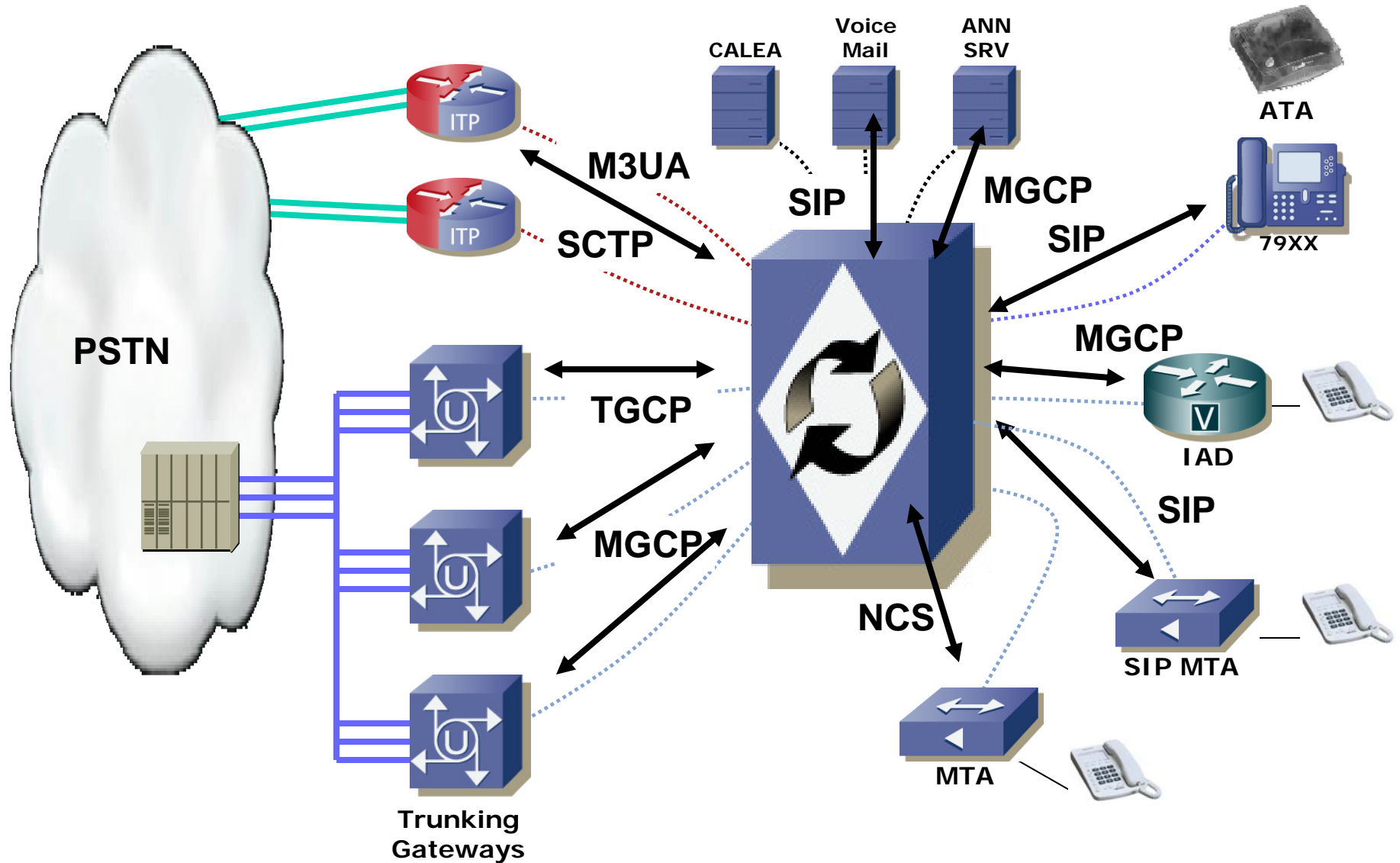
- Self-service Phone Administrator (SPA) for ease of subscriber provisioning
- Supports both traditional PSTN and IP/ATM specific billing needs
- Improve network efficiency through true IP internetworking realization
- Standards-based open commercial platform allows low-cost insertion and quick ROI

**Providing Packet Voice and
Call Control Intelligence for
Softswitch Networks**

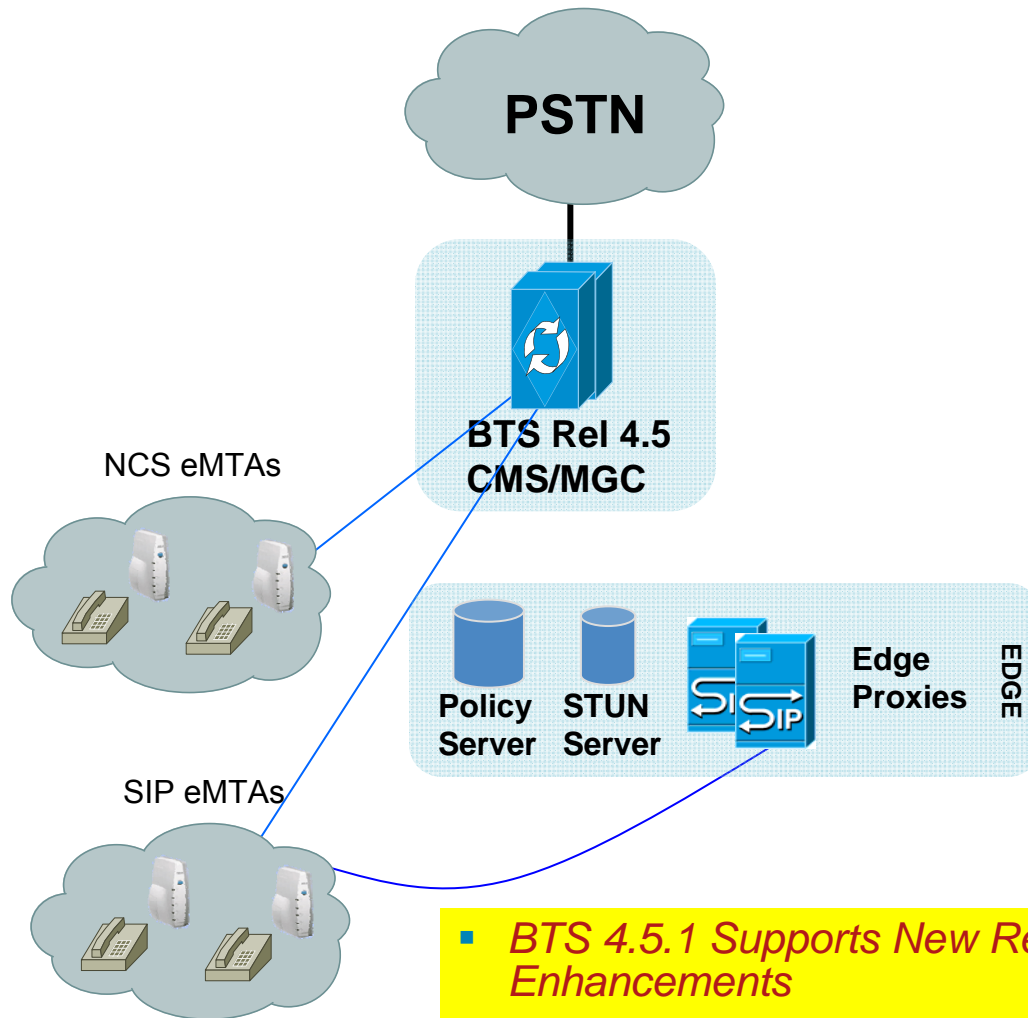
Cisco BTS 10200 Softswitch



BTS 10200 Interfaces



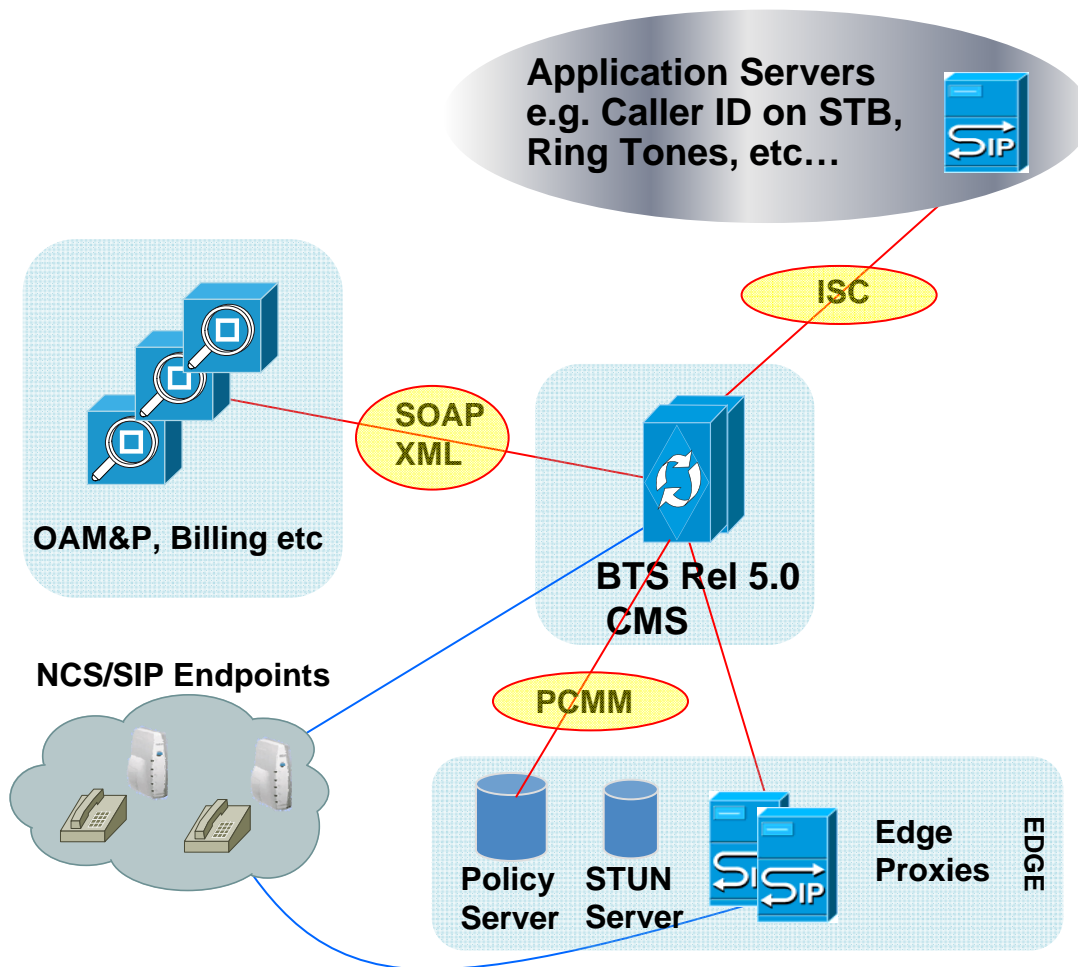
Release 4.5.1 – some highlights



- BTS Rel 4.5 Key Subscriber Features:
 - Star Code Access to VM
 - T.38 Fax Relay
 - Privacy Mgr
 - No Solicitation
 - Custom Dial plans
 - Temporary disconnect support.. among other features
- OAM&P Features
 - 125K subscribers per switch
 - Support for SPIROU
 - On-board DB for LNP

- *BTS 4.5.1 Supports New Residential Features and Operations Enhancements*
- Available now

BTS Release 5.0: Support Differentiating Features

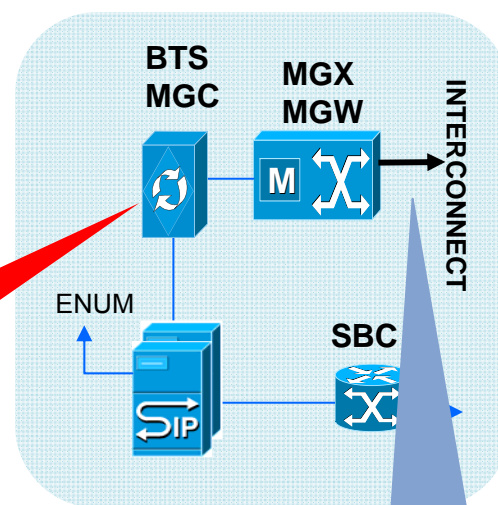


- SIP Triggers support on the BTS provided by the ISC Interface
- Capable of supporting multiple Applications like Caller ID to STB, Custom Ring Tones, Voice Dialing, etc to enable differentiating services
- Soap-XML interface on the BTS supports service provider OAM&P Architecture consolidation efforts
- Other key features include support for PacketCable Multimedia

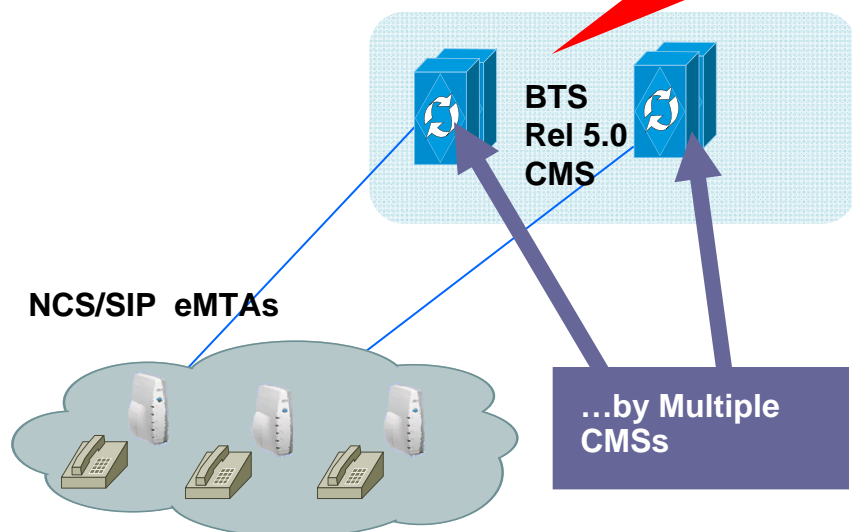
BTS Release 5.0: CMS Clustering - Improvements to meet Operator's Growth Needs

- Separate Softswitch into CMS and MGC...So They Can Scale Independently

Implement CMS/MGC Separation to enable Clustering



PSTN Interconnects can Be Shared...



- Doesn't require touching customers except during initial install when growing the market
- Allows for more efficient use of resources – PSTN Trunks, MGW ports etc across the subscriber base

BTS Release 5.0: Features enabling evolution to Next Gen Network

- Supporting ISC interface with SIP triggers for BTS integration with external application servers
 - Support both originating and terminating triggers based on ISC standard
- Physical separation of MGC and CMS functions from single Softswitch
- Continue enhancements of SIP end-points such as supporting SII for CALEA for SIP
- Cluster architecture

Cisco Media Gateways

Unmatched Density, Scale & Performance

- Highest VoIP density, scalability and performance
 - Up to 120,000 Redundant DS0s in a 7' Rack with ECAN Backplane
 - Capacity of 45 Gbps
 - Over 2000 Calls/Sec per 7'Rack
- Broad range of Network Interfaces
 - FE, GE, POS OC-12, T1, E1, T3, E3, OC-3c/STM1-OC48c/STM16
- Optimized for Service Provider Voice Applications
 - Broad Application Support for Wireless, Wireline, and PacketCable compliant applications
 - No single point of failure. Active calls preservation
- Investment Protection
 - Evolutionary, Pay-as-you-grow Design

MGX 8880 Media Gateway



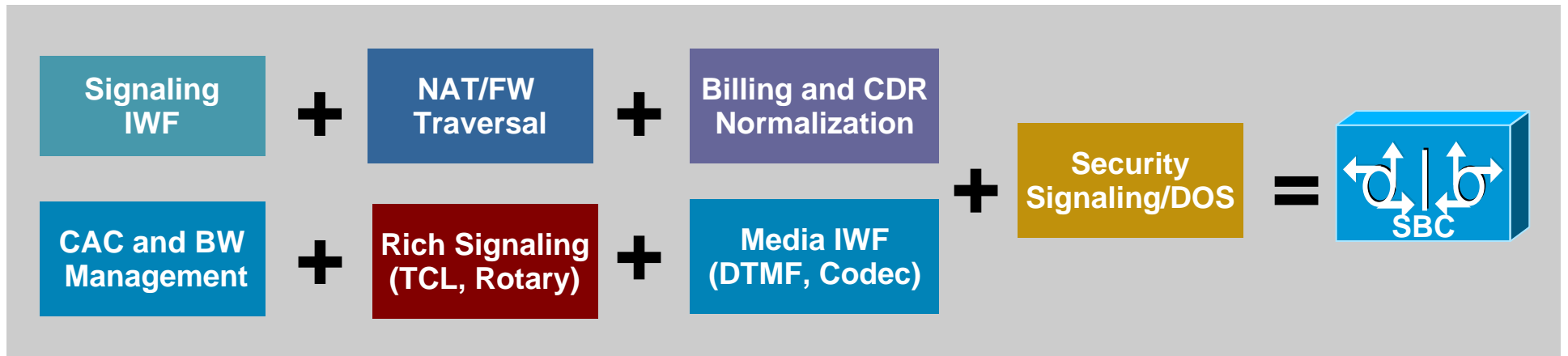
AS5350XM, 5400XM, 5850 Media Gateways



- Range from 2-8 T1/E1, to 8-32 T1/E1, to 24-86 T1/E1 or DS-3, STM-1 (240-4000 ports)
- Rich SIP Feature Set – compliant with most of RFC 3261, 3262, 3264
- All TDM interfaces (SS7/R2/T1CAS/PRI) are supported with SIP

Cisco's Session Border Controller (SBC) Cisco Multiservice IP-to-IP Gateway

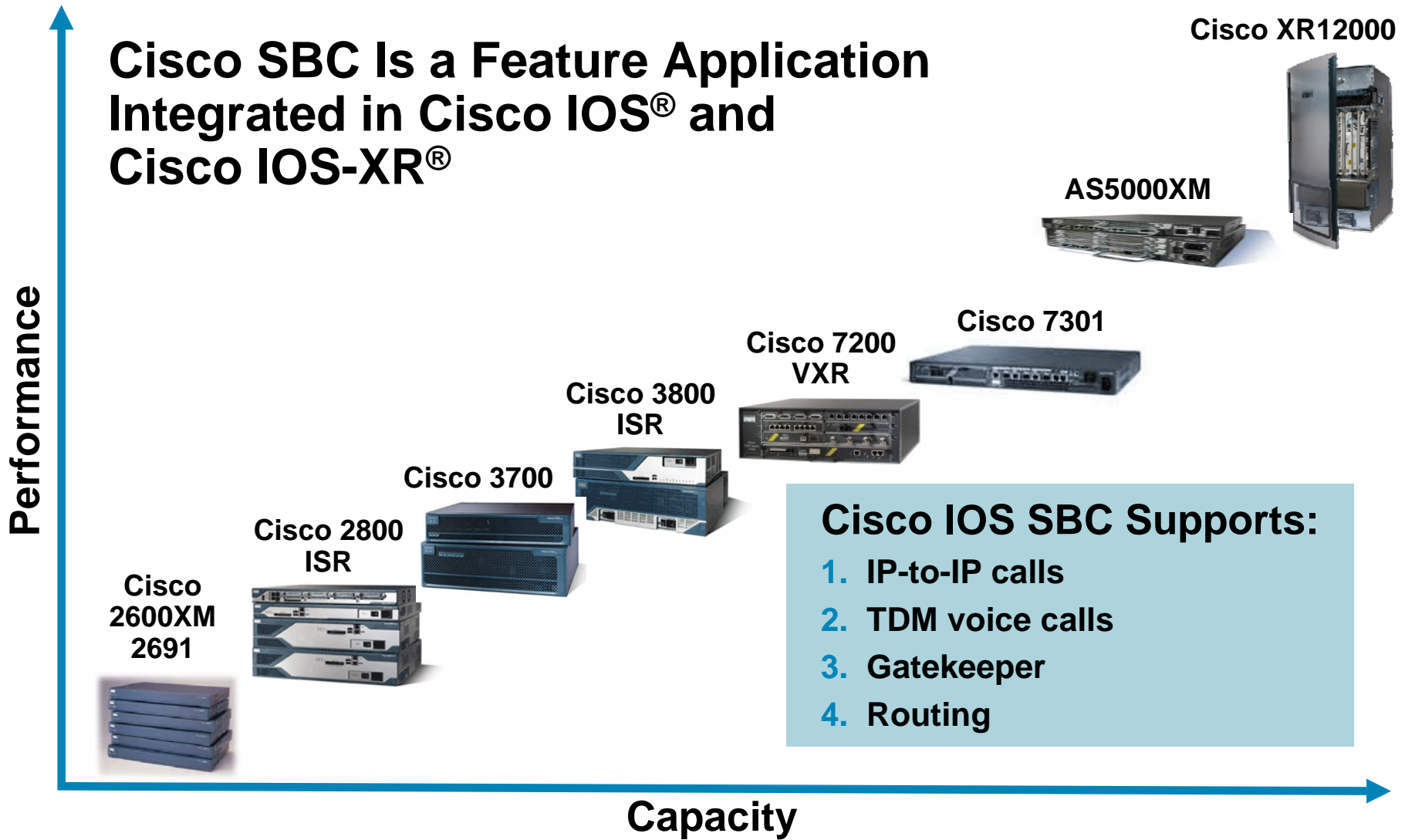
SBC Enables IP-to-IP Interconnect Between Multiple Administrative Domains for Real-Time Interactive Sessions



- SBC is a tool kit of functions
- Depending on the application and deployment scenario, a different set of functions can be turned on/off

Cisco Session Border Controller Portfolio

Platform Support



SBCs in VoBB deployments

- SBCs can play an important role in resolving NAT traversal issues (often encountered in residential voice applications with SIP)
- Can also be used for network-to-network traffic as this increasingly takes place as native IP interconnect

Fixed-Mobile Convergence



FMC – drivers for broadband operators

- More than 30% of mobile calls made from within the home -> opportunity for additional revenue for broadband providers
- Further differentiation from competitors
- Reduce churn even further by addition of mobility to existing triple-play offer
- Implementation: different approaches depending on operator's existing assets and plans (not “one size fits all”). Some operators will already have a wireless franchise (or become an MVNO).

FMC – Different Applications/Meanings

Cellular (2G/3G) and WiFi;
Roaming & Handover
(Single Number,
Single Device)

Seamless
Service

Dual Mode Device
(cellular and WiFi)
Manual Handoff

DUAL
MODE

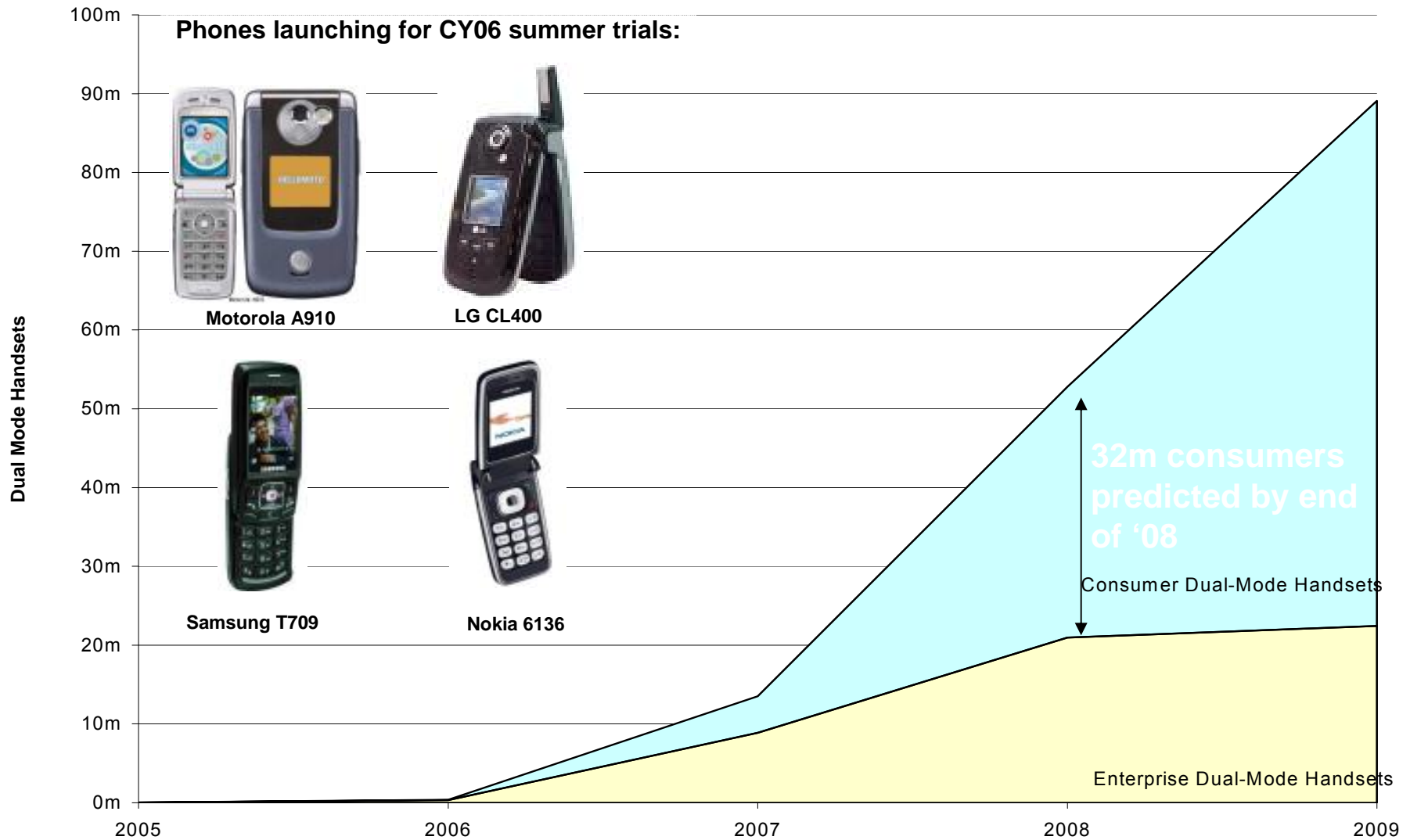
Single Number Reach,
Simultaneous Ring,
Switch Devices
(Single Number,
Multi-Device)

FIXED EXTENSION
TO MOBILE

Time to
Market

External Analyst Dual Mode Phone Forecasts

Consumer handset pipeline – mid-price/high-volume

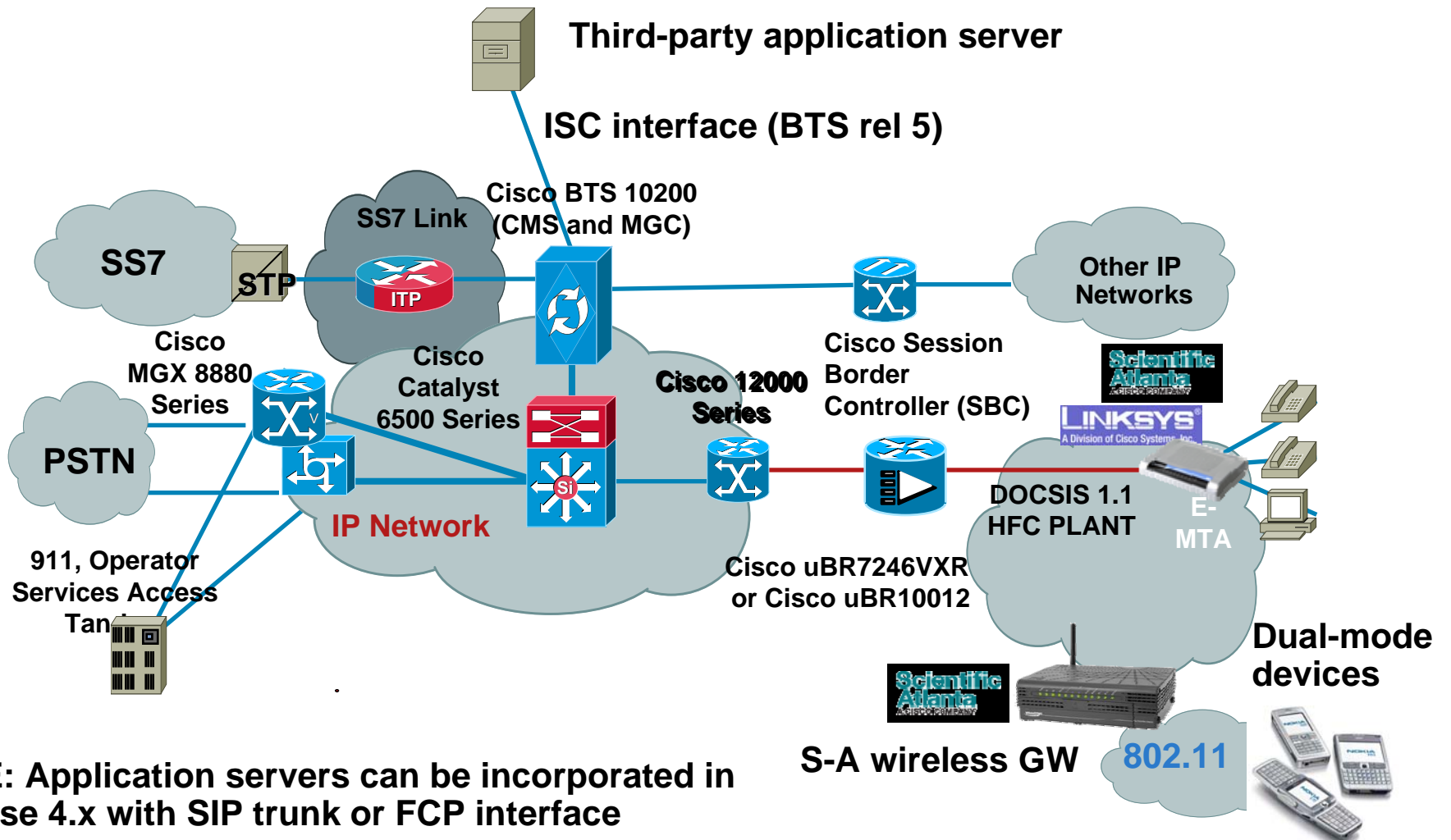


*Source: In-Stat, Wireless IP Phones Drive Future VoIP Markets, 8-05
 Other analysts (Senza Fili) predicting 55m installed base in 2010

FMC – pragmatic approach (Cisco, Linksys, S-A)

- Begin with current platforms and software releases (Cisco BTS, S-A EMTAs, gateways) – not all services depend on features in future releases
- Interop testing and integration
- Offer initial services (dual-mode device w/manual handoff, single number reach, etc.)
- Enhance service portfolio as new features (from product roadmaps) become available
- Add third-party components as needed (mobility manager)

Cisco/ S-A Integration for FMC



NOTE: Application servers can be incorporated in Release 4.x with SIP trunk or FCP interface

SP Voice Infrastructure Design Considerations



Platform scaling / Network Sizing

- Traffic per subscriber generally lower in residential than business applications (note: variable from market to market, and some elasticity depending on tariffs) -> oversubscription of shared resources
- In high-growth markets/ applications, provisioning schemes must be considered carefully

BTS 10200 Platform Scaling considerations

- BTS platform scaling depends on multiple variables
- As an over-simplification, system performance can be CPU-bound or limited by size of system database tables
- For small systems, CPU tends to be limiting factor
- For large systems, DB size tends to be limiting factor (increased size in successive BTS software releases).
- DB limits are 100K subs for r.4.4.1, 125K subs for r.4.5.1, 200K subs for r.5
- CPU performance: not 100% linear ratio between # of CPUs and performance, but quad-processor systems have roughly twice the performance of dual-processor systems

PSTN Interconnect / Connecting to other networks

- BTS 10200 may be able to handle this capability (depending on ISUP variants required), however PGW 2200 has been deployed as PSTN gateway for several BTS customers
- PGW can also be used to tie in other network traffic (managed voice services from business customers, for example)
- Increasing use of native IP-IP interconnect -> more widespread use of SBCs for network-network interconnect functions

Billing / Call Detail Records

- CDRs are useful for network measurements and statistics, even if not used for billing
- If on-net calls are not billed to subscribers, CDRs from interconnect elements (PSTN GW, SBCs) can be used to provide information to the billing system
- Call details can be obtained from BTS and PGW, and SBCs support a RADIUS interface for accounting

Local Number Portability

- In many markets this is a regulatory requirement
- Even when it's not, number portability makes it easier to attract subscribers to a new service
- Both BTS and PGW support on-board LNP databases
- Different methods in use for implementing LNP (Query on Release, All Calls Query, Onward Donor Based Routing, etc.)



Cisco Hosted & Managed Voice Solution



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Agenda

- Cisco Hosted & Managed Voice Solutions
 - Introduction to BVS & HUCS
 - HUCS Architecture & Key Concepts
 - Case Studies
- Q&A

Introduction to BVS & HUCS



Cisco Business Voice Solution (BVS)

- Enables Service Providers to deliver **revenue generating services** based on Cisco IP Communications to enterprises and SMBs
- Allows Enterprises and SMBs to **mix and match deployment models** (own premise vs. SP's Data Center) and **management options** (self vs. SP-managed) for IPC services across various locations
- Ensures **application inter-working, feature transparency, and PSTN connectivity** for business voice services across a range of IP and TDM deployment options

Cisco BVS – Services Description

- The SP iBVS Solution enables Service Providers to deploy a portfolio of managed voice services to offer any combination of services including:

- **Business Voice Access, ie TDM PBX and IP PBX Trunking**

Access to PSTN

Virtual BRI/PRI service with onnet calls routing, centralized PSTN breakout, International long-distance

DPNSS/Q.SIG Backhauling for TDM PBX enable IP PBX migration

CallManager and CallManager Express interconnection

- **Voice VPNs**

Access to remote sites with voice VPN

TDM/IP PBX Interconnection with support of private numbering plans

- **Hosted CallManager Services**

Hosted IP Telephony Services

Carrier Scale Cisco CallManager Services

H-UCS (Hosted Unified Communications Services)

- H-UCS builds on BVS solution adding the following key capabilities
 - A Service Management and Application Enablement Wrapper
 - “Virtualised” CCM services (i.e. partitionable)
- H-UCS is Cisco integrated and validated including the following third party components
 - Vision OSS BVSM platform
 - IP Unity Voicemail/UM platform
 - Netwise Attendant Console
- Allow (A)SPs to offer Cisco IP Telephony services to large, medium and in some cases small enterprises – leveraging Cisco R&D and market development activities

Deployment Models

- The H/M-UCS reference architecture can be used to support the following models for hosted and managed services:

Hosted Multi-Tenant

Hosted Dedicated

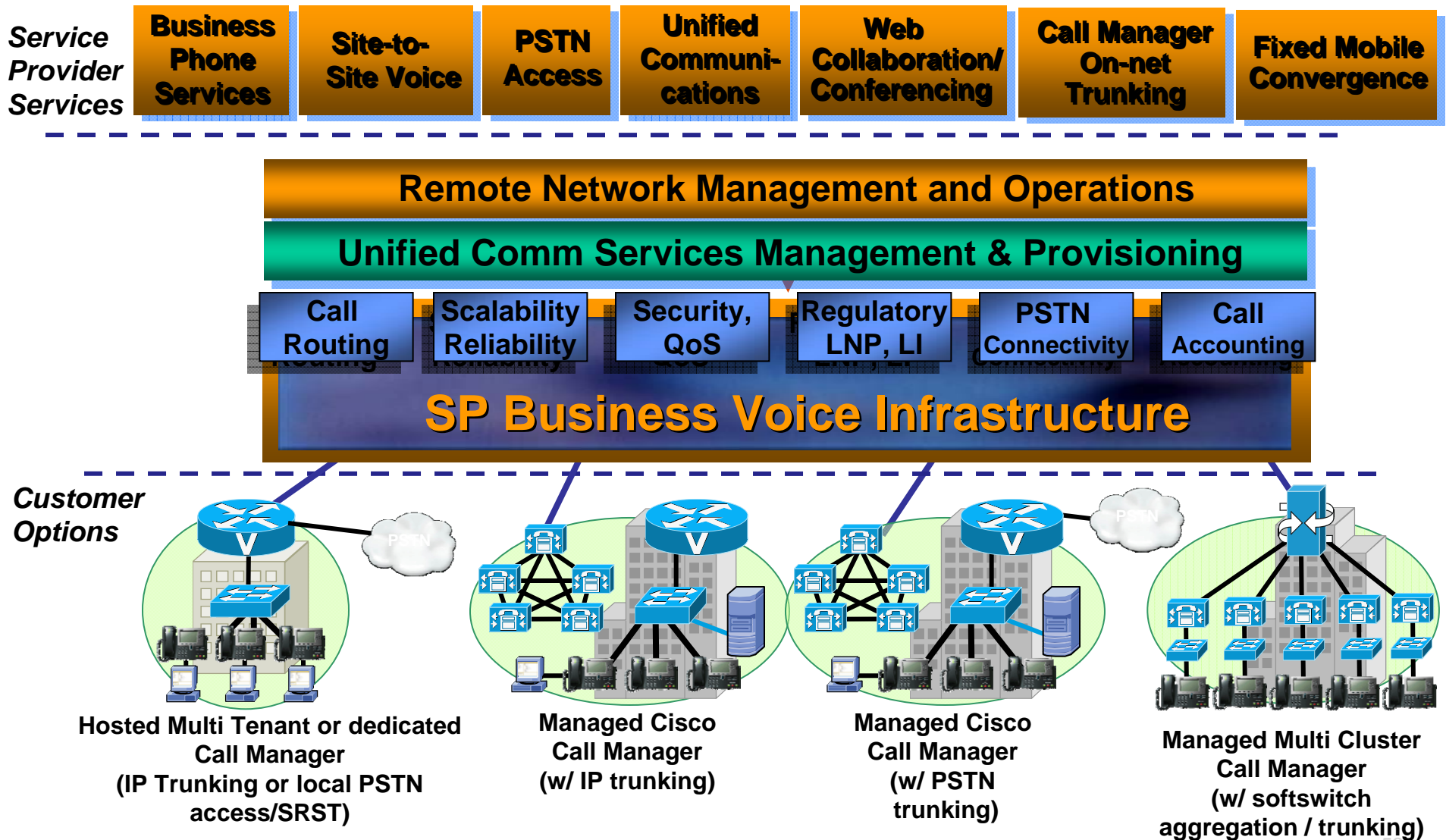
Managed with On-Net trunking (M-UCS)

Managed with PSTN trunking (M-UCS)

Managed Multi Cluster with softswitch aggregation for routing and trunking – aka. large single enterprise

Cisco Hosted/Managed – Unified Comm Services

Enabling a Portfolio of Business Voice Services



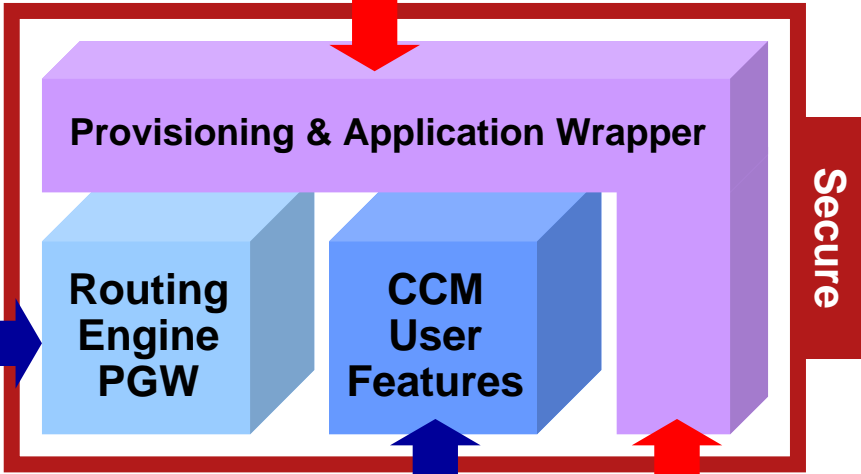
HUCS Architecture & Key Concepts



Solution Principles

- Admin & Operational Features**
- Business Logic Based Service Definition & Data Input
 - GUI and Bulk Data Input
 - Supports Direct Sell or ASP Branding (tiered)
 - Automated resource allocation & management

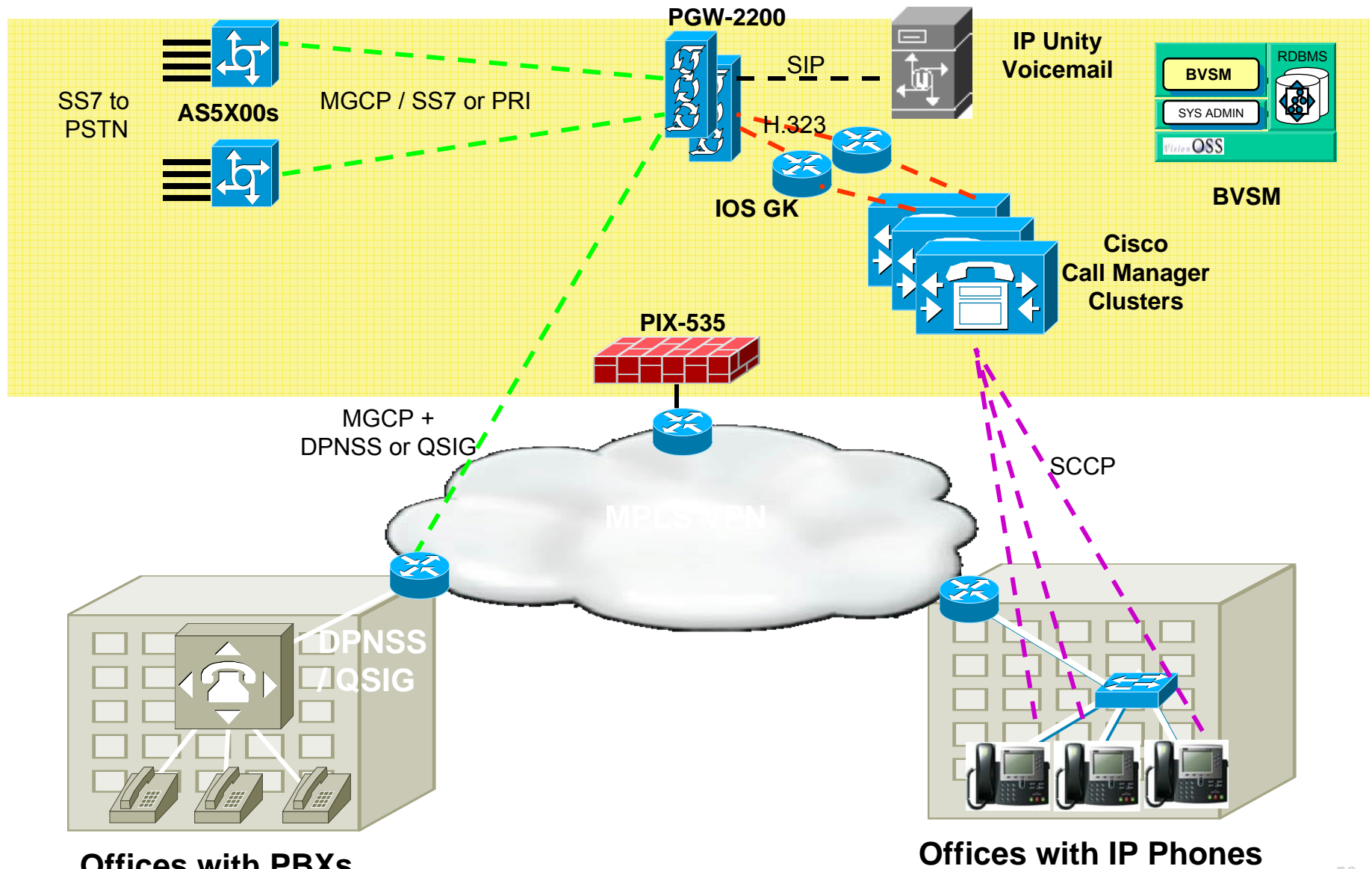
- Network Connectivity**
- SS7
 - PRI, Q.Sig, DPNSS
 - SIP & H.323
- Regulatory Functions**
- Number Portability
 - Emergency Services
 - MCID
 - Lawful Intercept
- Advanced Routing Capabilities**
- VPN, LCR etc
 - E.164 & IP based
 - Billing Record Generation



- User Features**
- Partitioned CCM Clusters
 - Majority of CCM features preserved
 - Full range of user devices supported
 - Enhanced Apps (AT & VM/UM)

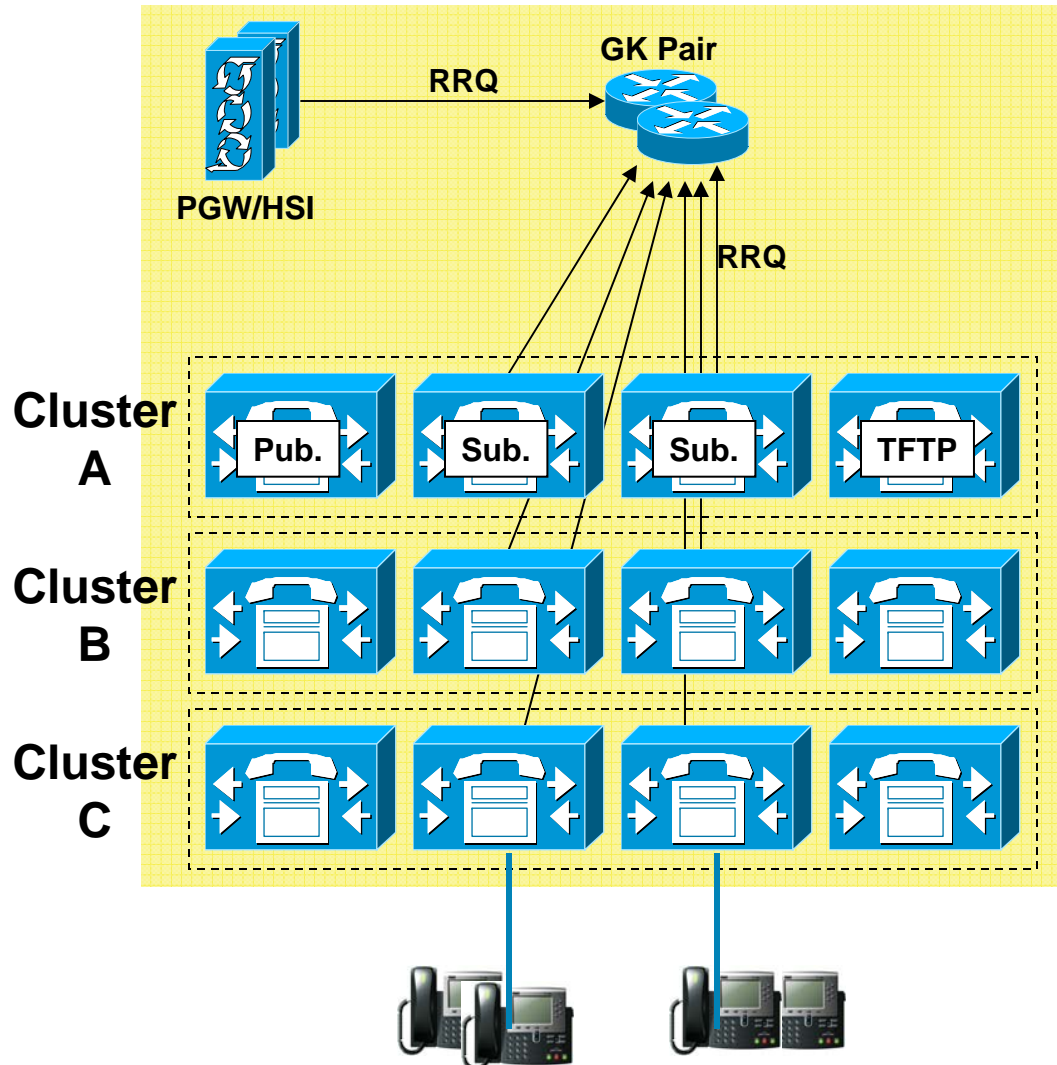
- User Features**
- Partitioned Self Care & Service Activation
 - Local Admin Capabilities

H-UCS Platform Design



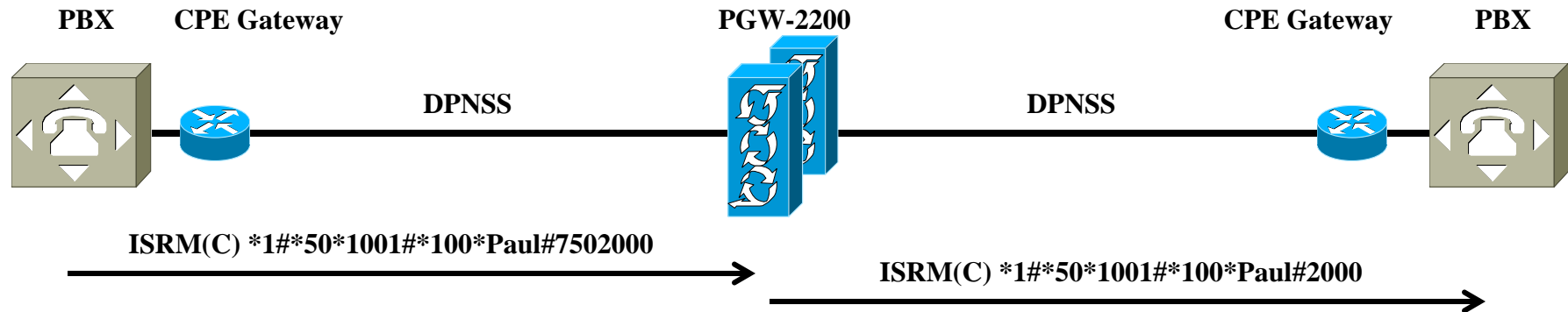
Gatekeeper Function

Service Provider PoP



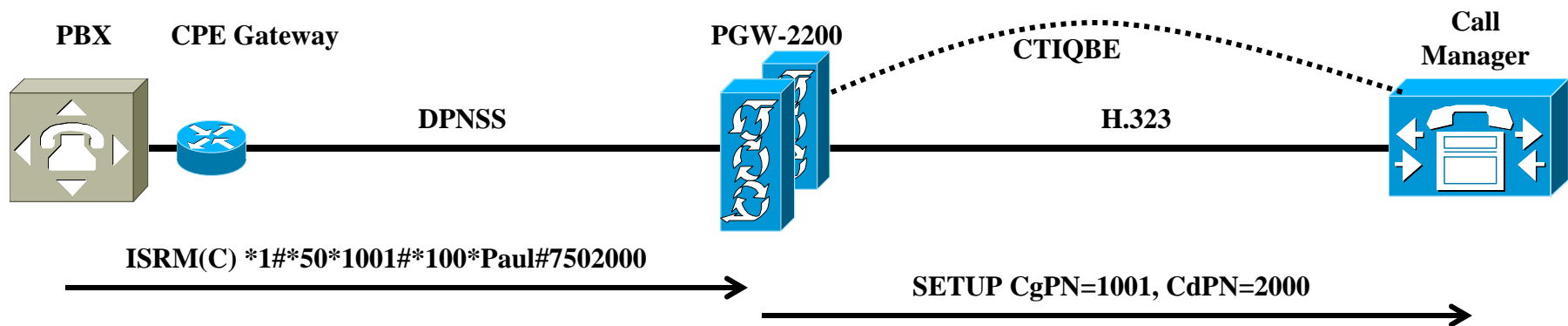
- CCM cluster members register with GK with CPID (call processing ID = Cluster ID)
- Gatekeeper routes calls to the correct cluster downwards as PGW prefixes called number with CPID
- Gatekeeper load balances calls among subscribers within a cluster
- HSIs register with GK with default GW prefix
- Gatekeeper load balances calls among HSIs
- Gatekeeper allows for failure of HSIs or subscribers

PGW-2200 DPNSS Protocol Support Transit Node - PBX Transparency



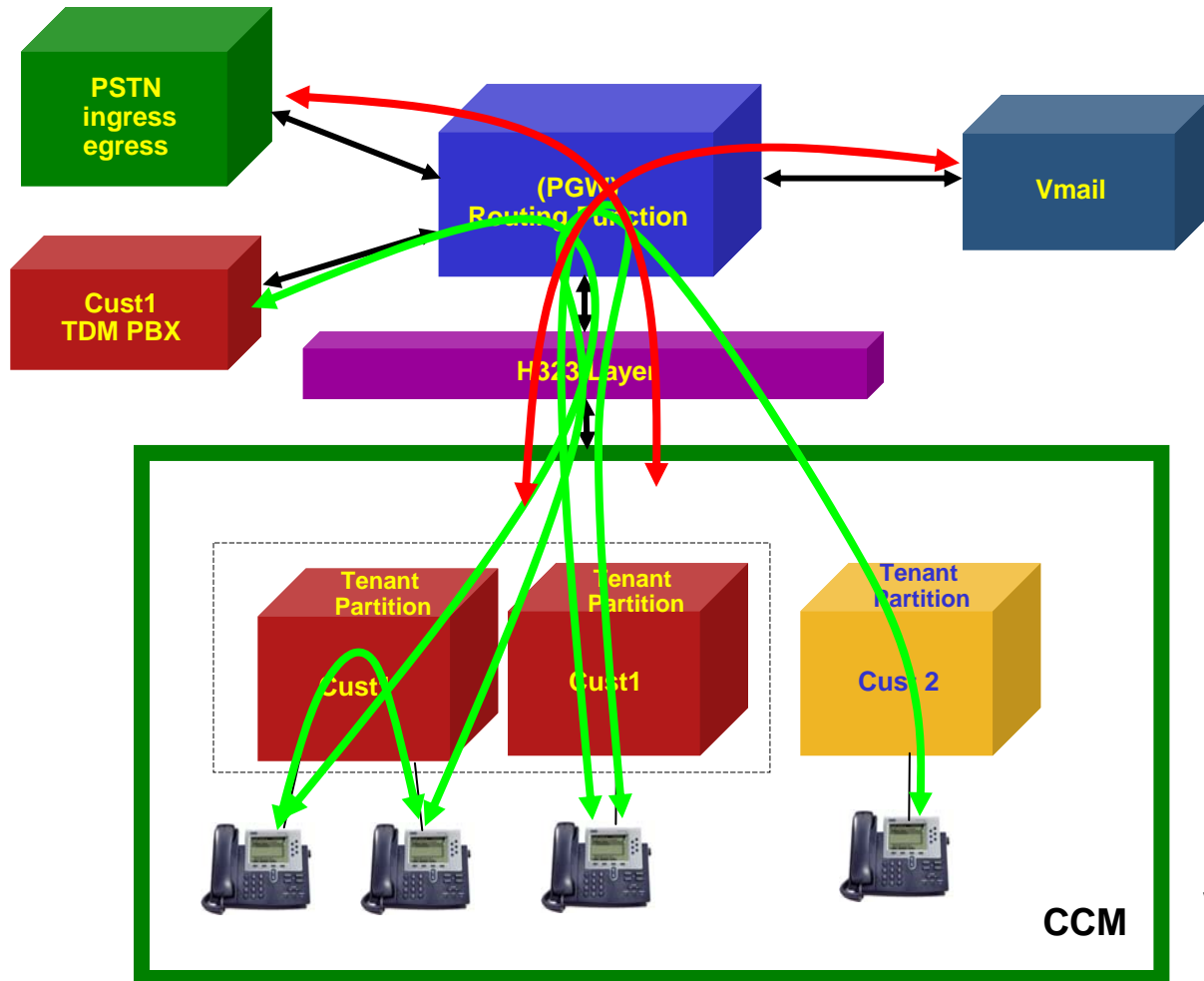
- DPNSS is a very feature-rich protocol
- PGW provides full feature transparency for all PBX-to-PBX services
- Examples are: Centralised Operator, Callback When Free, Name, Forward, Transfer, Route Optimisation

PGW-2200 DPNSS Protocol Support End Node - Interworking



- DPNSS to H.323 (Callmanager) or DPNSS to SS7
- PGW actively supports:-
 - Call Hold, Call Forward, Call Redirection, Three Party Service (Shuttle, Transfer), Extension Status, Call Waiting, Call Offer, Callback when Free, Route Optimisation
- Other features gracefully rejected
- PGW 9.7 (H-UCS V2.0) replaces CTIQBE with Q.SIG over H.323 Annex M1 to achieve similar feature set

Overview of Call Routing in Multi Tenant H-UCS



**Calls intra site do
Not go via PGW**

**Calls to other sites
of the same Ent. or other
Enterprise
Will be forced on-net**

**TDM PBX's are included
In the Cust's dialplan to
allow On-net calling**

**Vmail is a centralised resource
in the MT dialplans**

H-UCS Key Concept : Data Schema

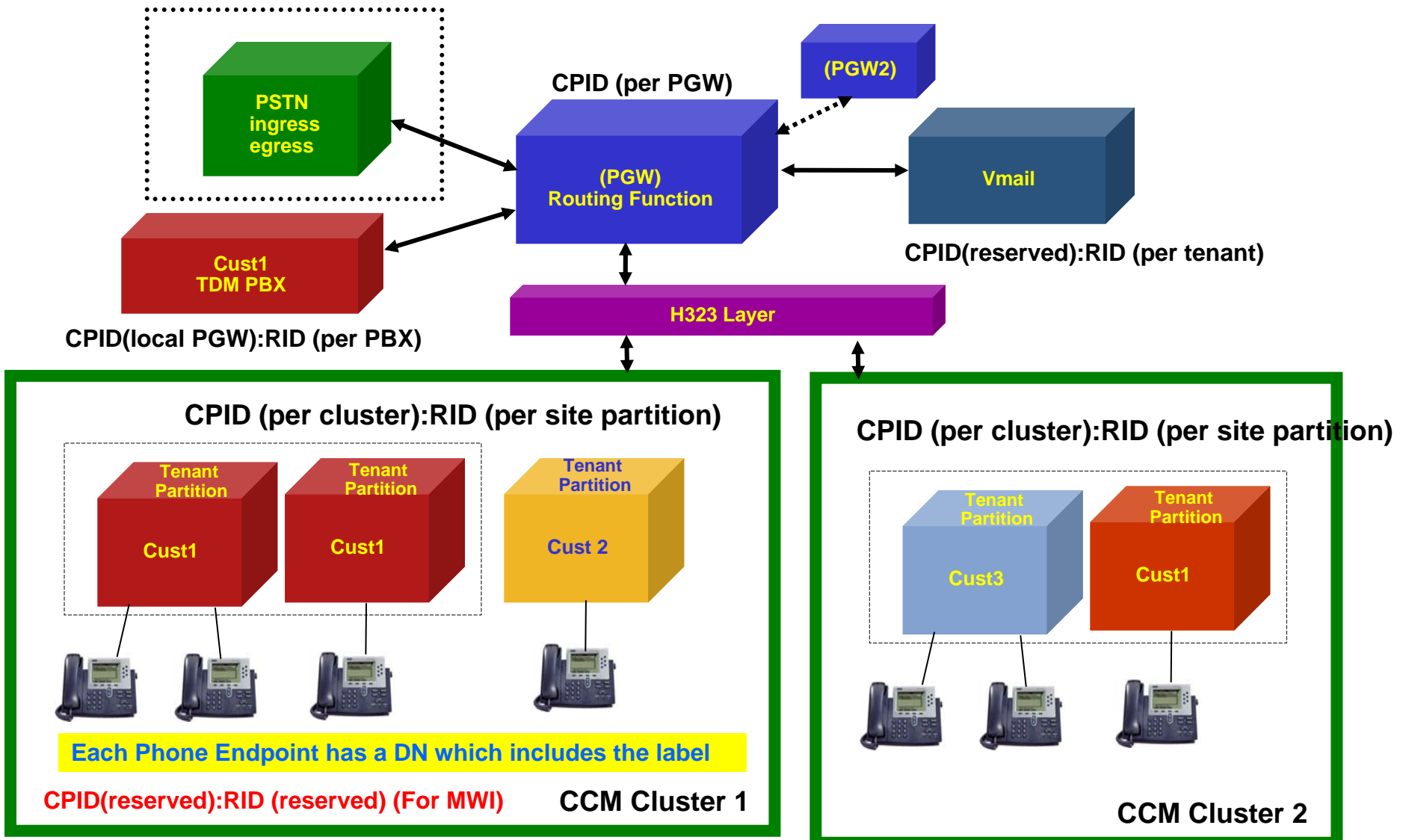
- The solution is driven by a user hidden data schema.
- CCM sends the A number (CLI,CgPN) in formats that include a prefix (**routing label**) to the PGW.
- The PGW has knowledge and relationship information for these **routing labels**. It 'owns' the E164 numbers that map against the customer partition labels
- This concept is extended to all devices in the solution, where they ingress to PGW, each device will have a prefix assigned, and this prefix is used for routing
- BVSM distributes the relevant data across the call processing platforms

PGW received number formats/terminology

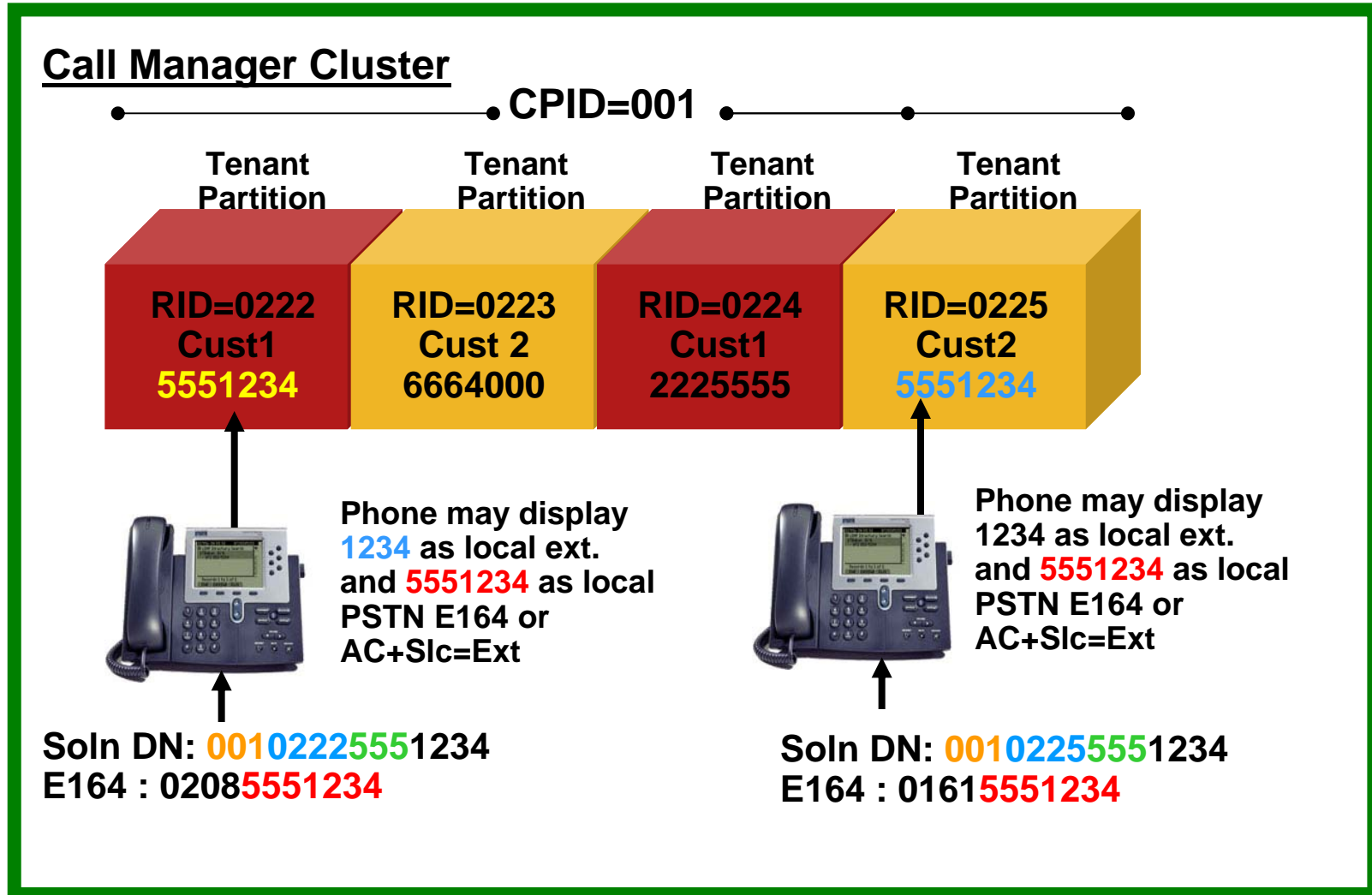
- **A Number Label**
- **CPID** – call processing ID, (per CCM cluster or PGW)
- **RID** – Route ID (per CCM site partition or per PBX)
- **CT** – Call Type
 - Defines the **DESTINATION** type for the CALL and forms part of the label on the A number
 - CT=9 (to PSTN/offnet)
 - CT=8 (onnet site/site type call)
 - CT=6 Forwarded Call to onnet site (src could be PSTN or onnet)
 - CT=5 Forwarded Call to PSTN (src could be PSTN or onnet)
- **SLC** – Site Location code, variable length (could be E164 AC)
- **Extn-** Extension – Could be unique DDI or site specific DN
- **B number Prefix**
- **oPX** = Offnet prefix (ie 9 or 0 etc) unique per site
- **iPX** = Onnet prefix (any digit not oPX) unique per customer

BVSM Usually defines the CPID and RID dynamically for a specific site CPID and RID are not fixed lengths. Today we commonly use 3 dig for CPID and 4 for RID.

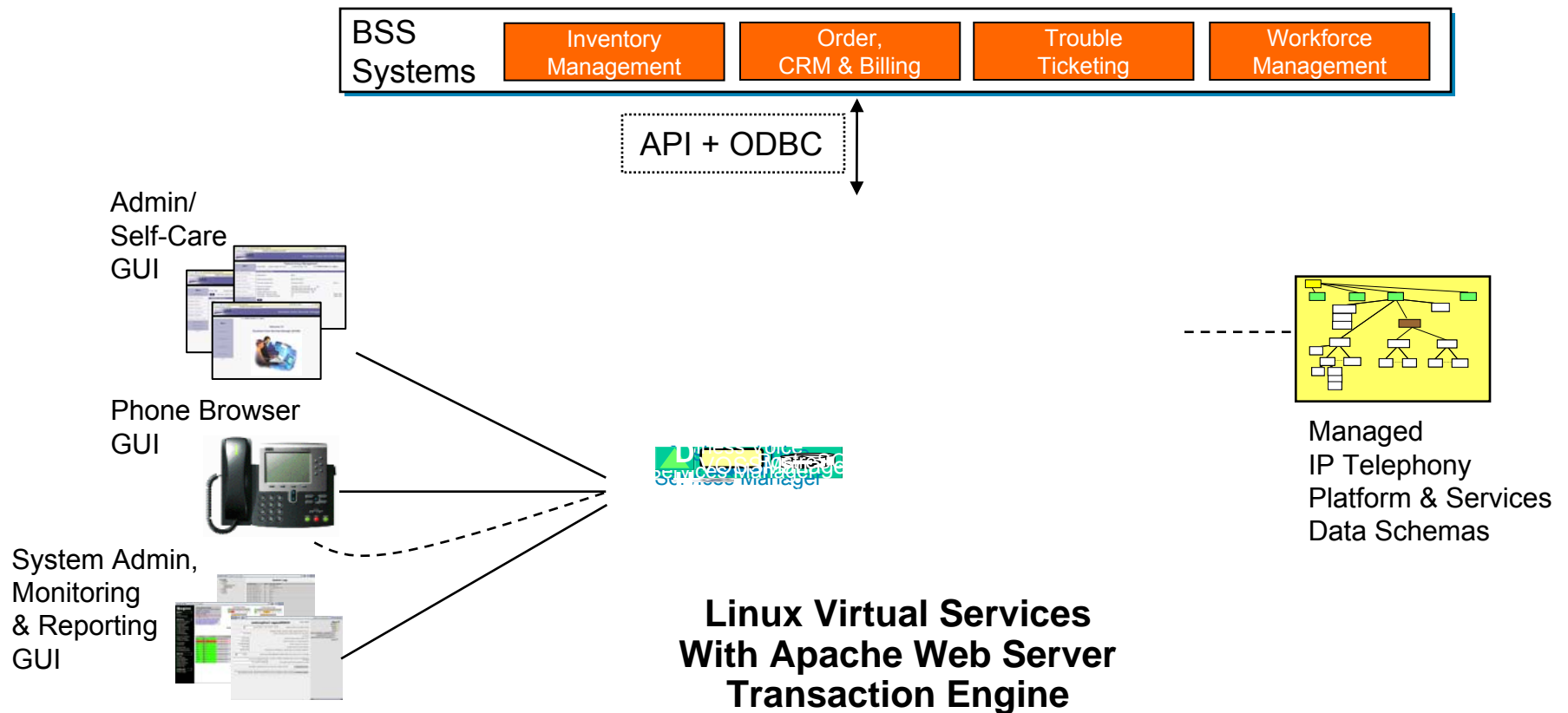
Label Allocation in H-UCS Multi Tenant



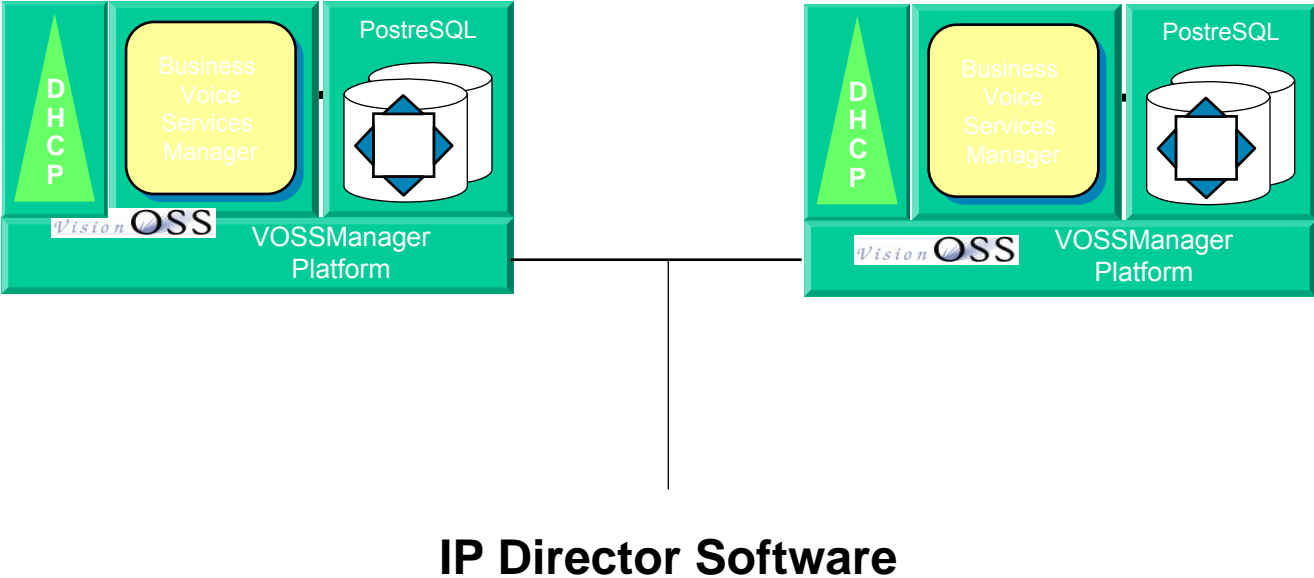
CCM partitions and Routing Labels Dealing with Overlapping Numbers



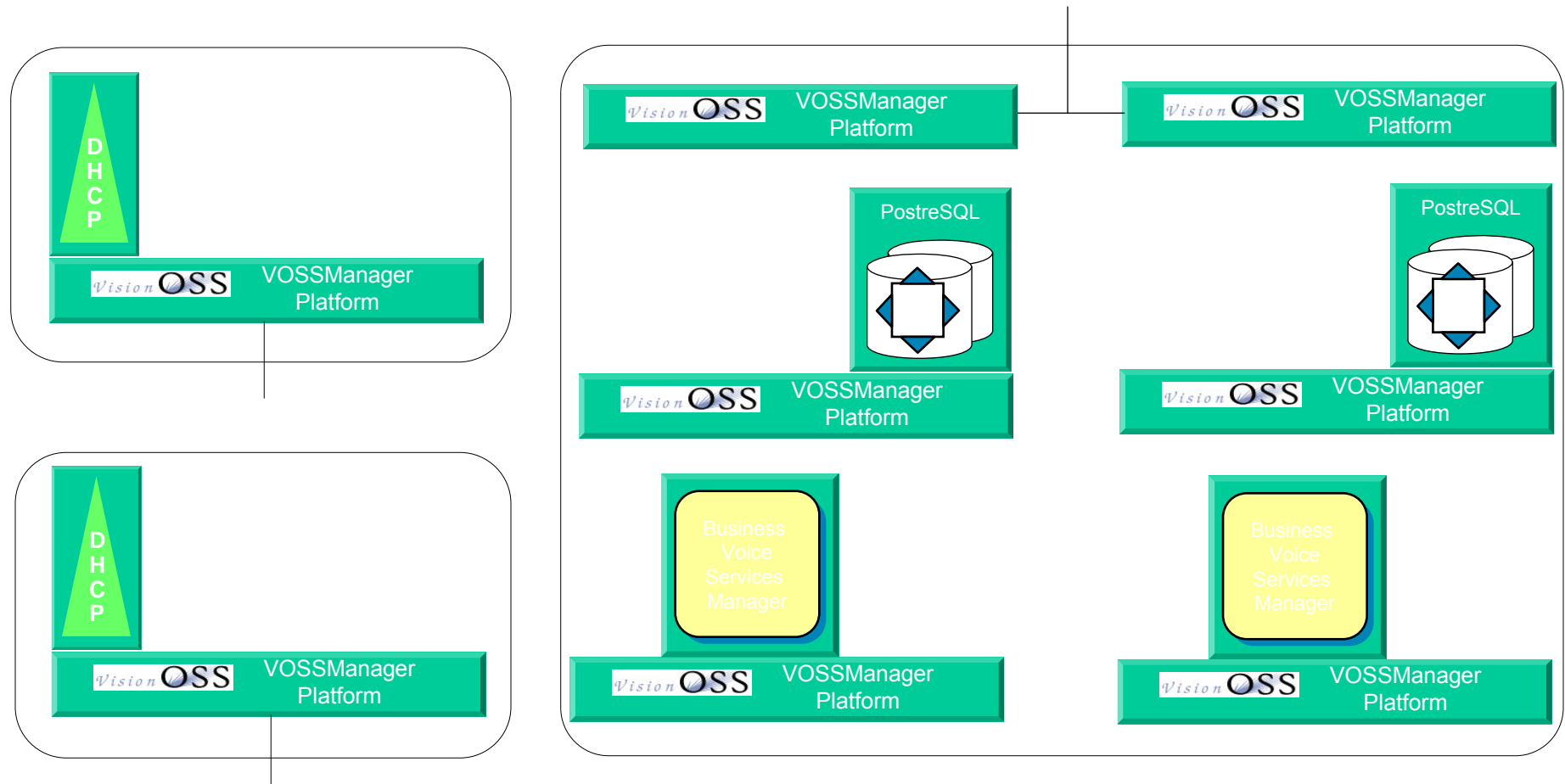
VisionOSS BVSM Components



BVSM, High Availability

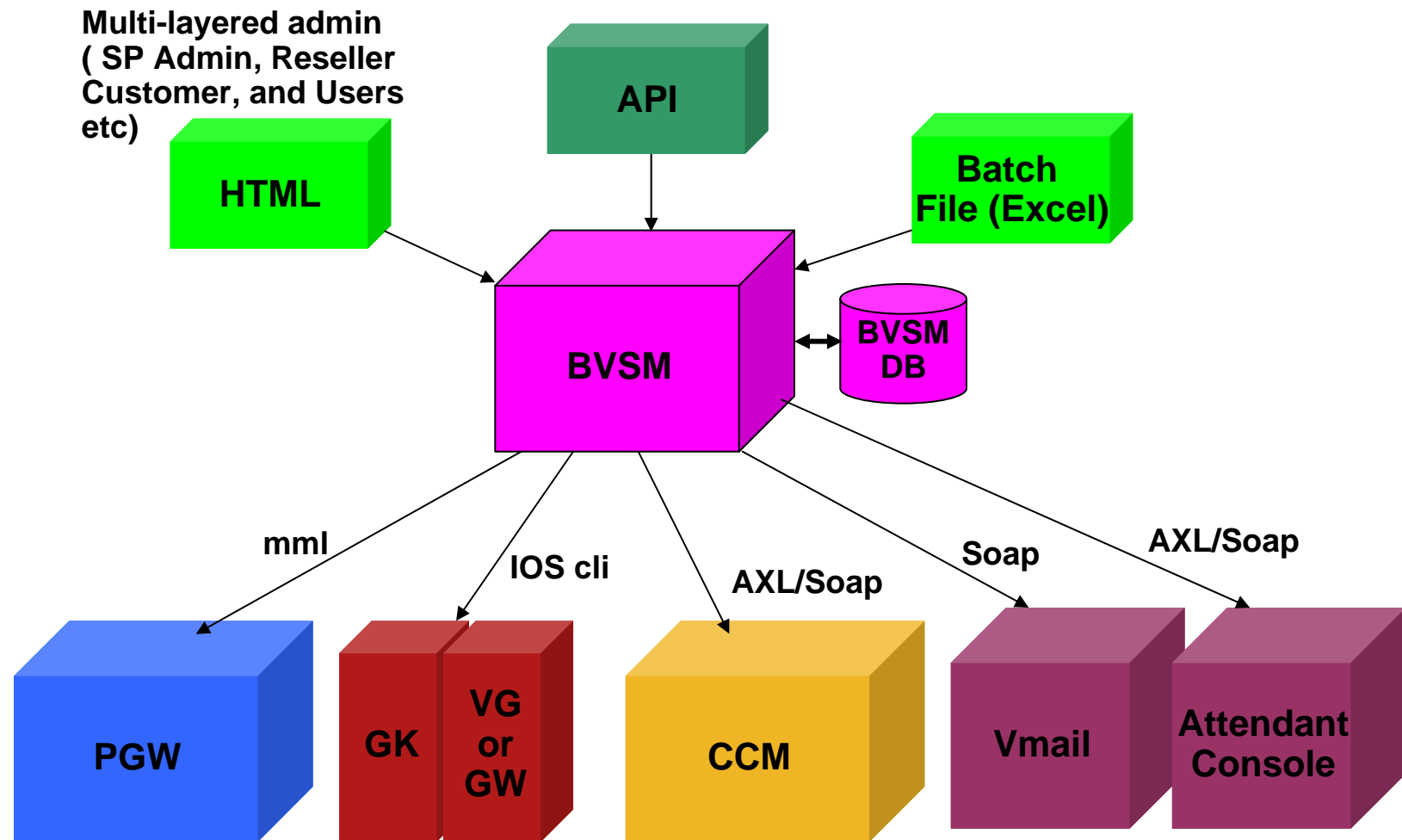


BVSM, Distributed Architecture (Cluster)



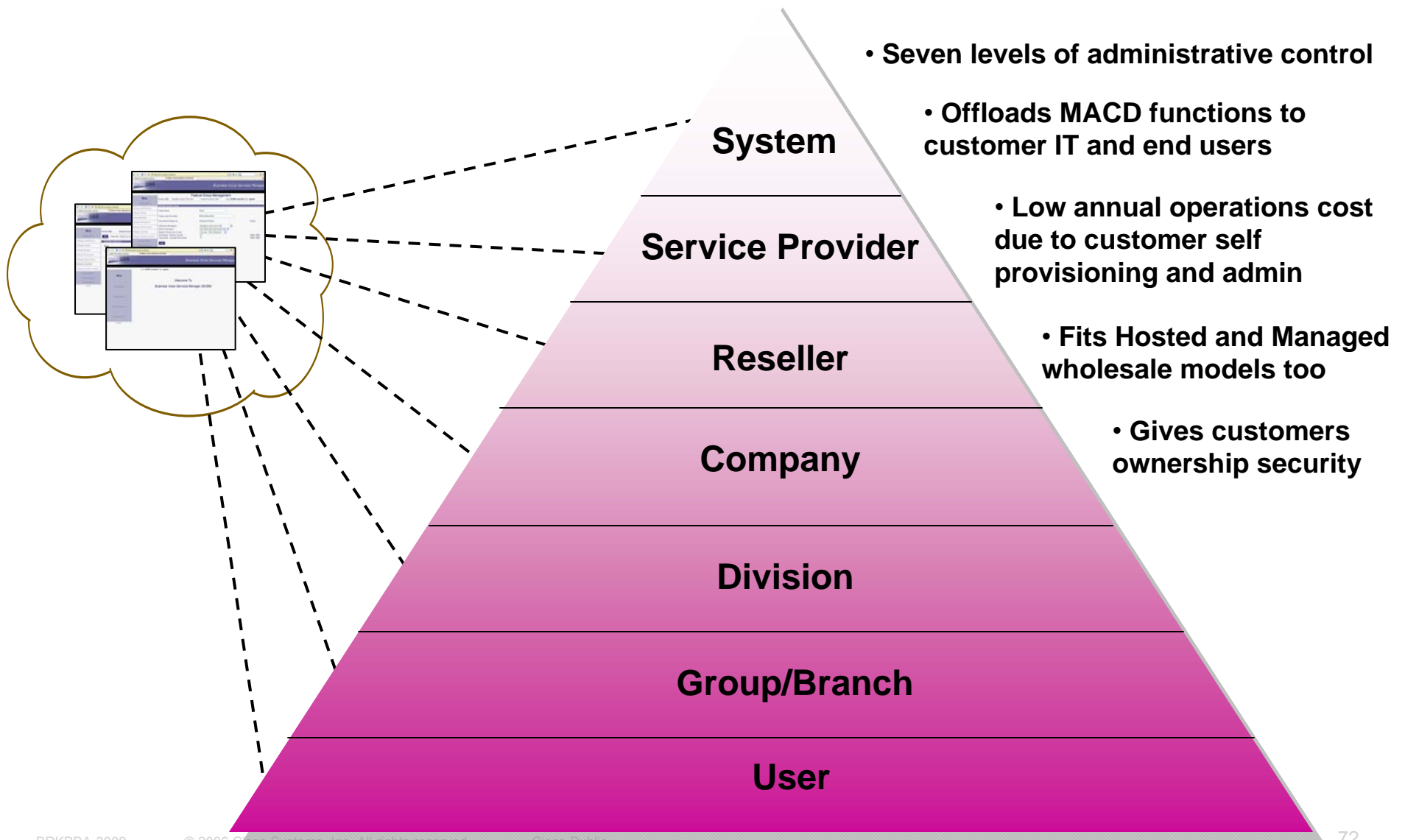
Elements of the application software can be distributed

BVSM Provisioning



BVSM push provisions all the above using different API's

BVSM Multi Level Administration



BVSM XML Application Hosting

- BVSM takes over hosting of the corporate directory to allow multi-tenant partitioning.
- BVSM takes over the EM logon/logoff to provide security between tenants on the same CCM cluster
- BVSM hosts a set of XML apps providing enhanced functionality on the phone
 - Speed dial editing
 - Call forward settings for all, busy and no answer
 - Personal Directory access and Editing

Scalability Inputs and Factors

- Callmanager SRND –
Tested limits e.g locations ≤ 500
- Callmanager Capacity Tool –
Call rate and numbers of devices gives cluster sizes in terms of cpu so type and numbers of servers
Number of DNs, routes, translations gives memory usage and limit on cluster size
- PGW capacity Tool
Call rate and memory use (simultaneous calls) gives type of machine required and ultimately number of PGWs needed
- Gatekeeper Scaling tool
Callrate and held calls determines size and number of GK

Scalability of Architecture

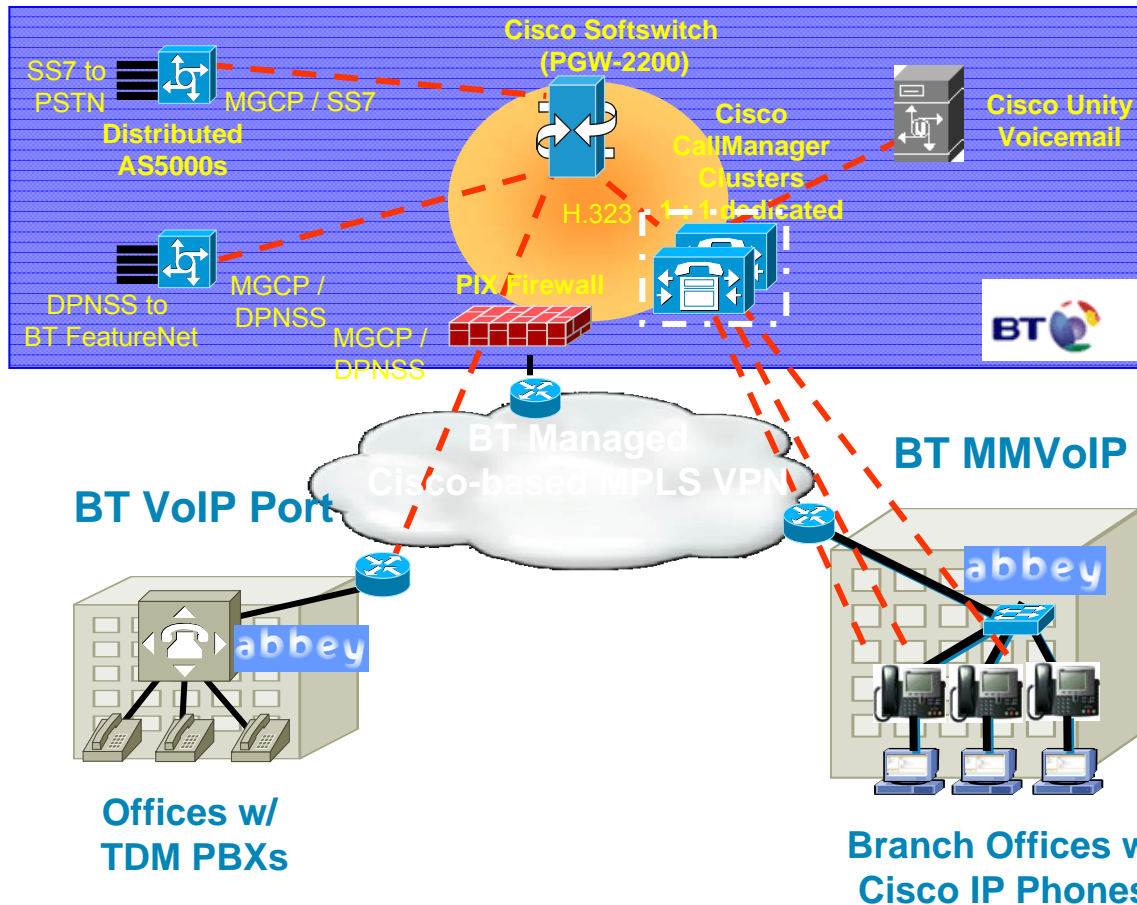
- BVSM can manage many CCM clusters and multiple PGWS so ultimately the whole *platform* is quite scalable
- Scalability per CCM cluster is therefore less of an issue but needs to be designed
 - Use CCM Capacity tool and SRND
- PGW Scale
 - Use capacity tool
 - Need to know % mix of calls going between sites (EISUP from HSI to EISUP) vs. to PSTN (EISUP to SS7 or PRI etc)

Case Studies



Business Voices Services Case Study: British Telecom

BT's Business Voice Services – NOT 100% H-UCS but similar architecture



abbey

- Installed 2003
- 6th largest bank in U.K.
- Targeting IPC for comp. advantage
- 32 HQ Offices - DPNSS TDM PBX interworking w/ IPT & IP VPN to replace leased lines (**VoIP Port**)
- 750 Branch Offices
 - were on mix of FR, ISDN, DSL KTS
 - migrated to high speed networks w/ IP Phone connectivity to Voice VPNs & BT managed CCM (**MMVoIP**)

Key Benefits:

- Network consolidation
- Improved branch capabilities
- Improved flexibility & efficiency
- Millions of pounds in cost savings

H-UCS Live Deployment - LloydsTSB

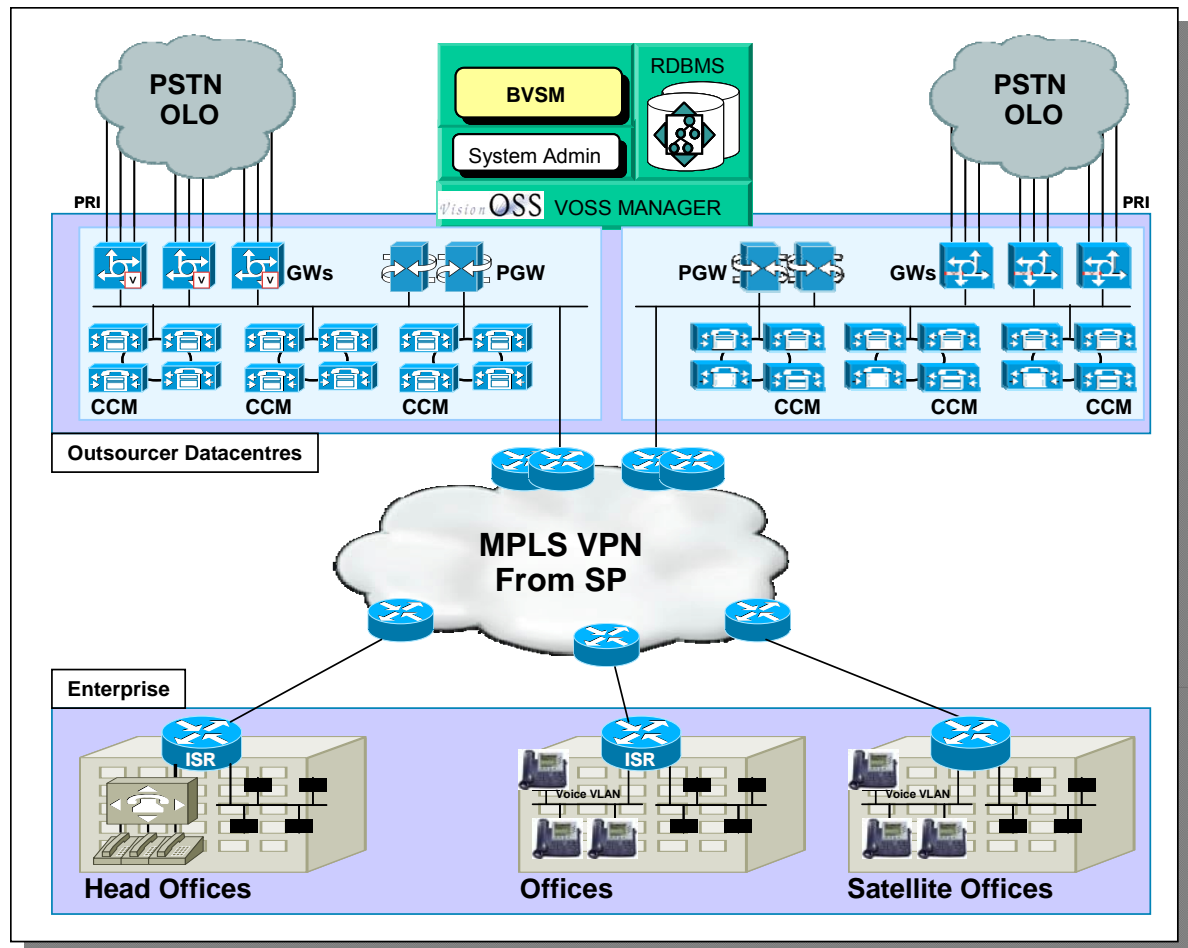


Lloyds TSB

H-UCS Architecture For -

- 70k phones
- 200 main offices
- 2400 branches
- NOT Multi Tenant
- 7 CCM clusters being deployed
- Centralized PSTN access

Lloyds TSB is a leading UK-based financial services group, which was created in 1995 following the merger of the TSB Group and the Lloyds Bank Group. Its businesses provide a wide range of banking and financial services in the UK and overseas, principally through branches of the Lloyds TSB Bank and its wholly owned subsidiaries.



Summary

- H/M-UCS is

- A Multi-tenant capable managed or hosted business voice architecture

- Reference designs are tested by Cisco NSITE

- Aimed at business voice not residential or really small enterprises

- Leverages high touch account teams selling CCM functionality

- Covers both hosted and managed CCM as well as TDM PBX interconnect and SS7 PSTN interconnect.

- Design includes provisioning layer (BVSM)

Meet the Experts

IP NGN Architectures and Technologies

- Oliver Boehmer
Network Consulting Engineer
- Moustafa Kattan
Consulting Systems Engineer
- Yves Hertoghs
Distinguished System Engineer
- Ed Draiss
Product Manager



Recommended Reading

BRKBBA -3009

- Continue your Networkers learning experience with further reading from Cisco Press.
- Visit the on-site Cisco company store, where the full range of Cisco Press books is available for you to browse.



Q and A



Other Sessions of Interest

Next Generation Service Control Plane	07-FR1-BRKBBA-3003
Service and session management in IP NGN networks	07-FR1-TECBBA-1002
Session border controllers for NGN platforms	07-FR1-BRKBBA-3011

