COMVERSE

making your network smarter

ComverseONE

Converged Billing & Active Customer Management

Comverse ONE®

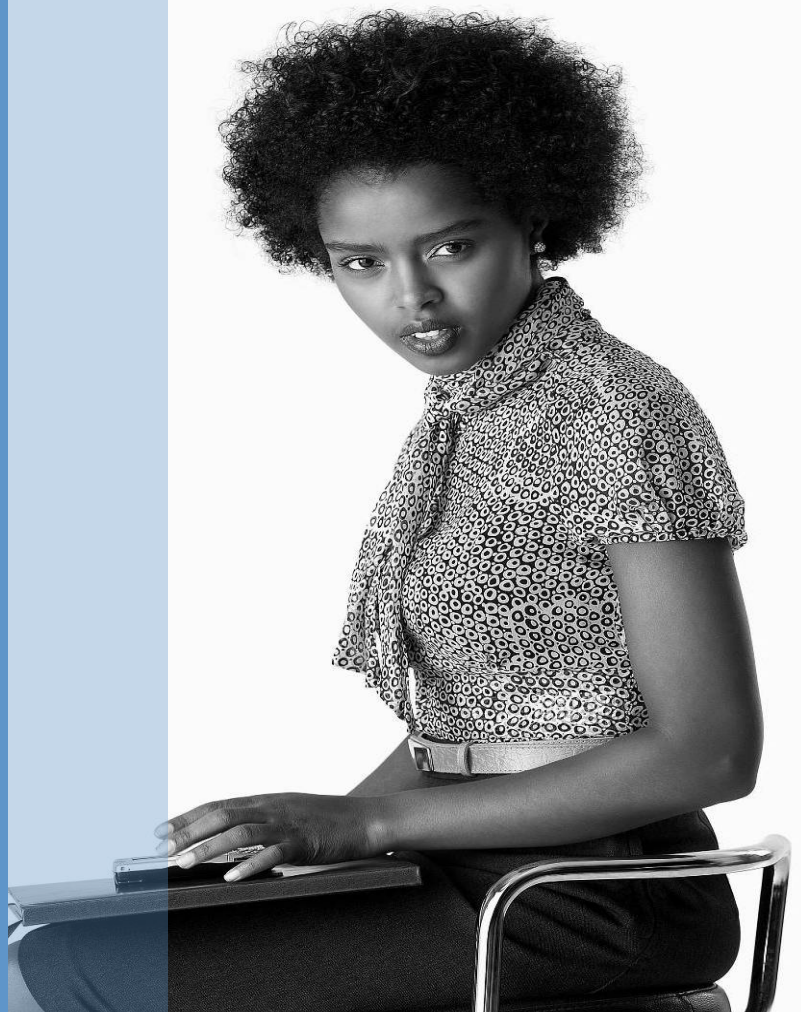
Architecture Review with Oi

October 2012

Disclaimer

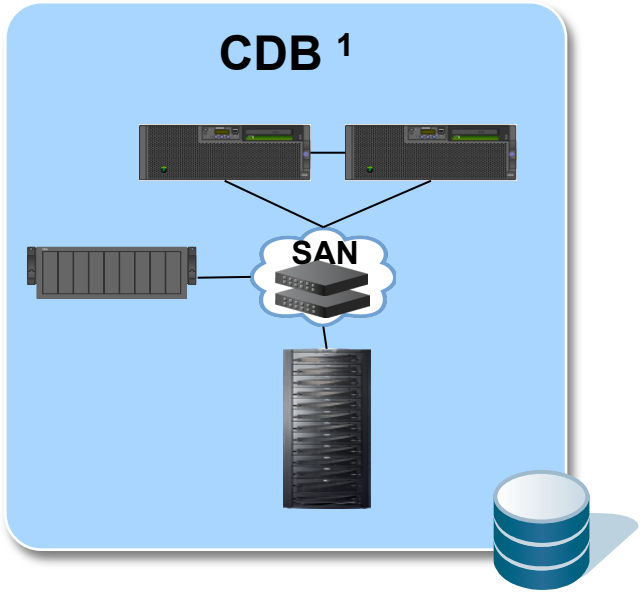
- **NOTE:**
- *All information, if any, relating to Comverse's product roadmap is provided solely as a non-binding expression of Comverse's present intent and is not and should not be deemed to constitute any form of commitment, promise or legal obligation to develop, offer or deliver any product, upgrade, enhancement, software, hardware, documentation or functionality whatsoever. The development (if any), release (if any), and timing of any feature or functionality is and will remain at our sole and absolute discretion.*

Scalability

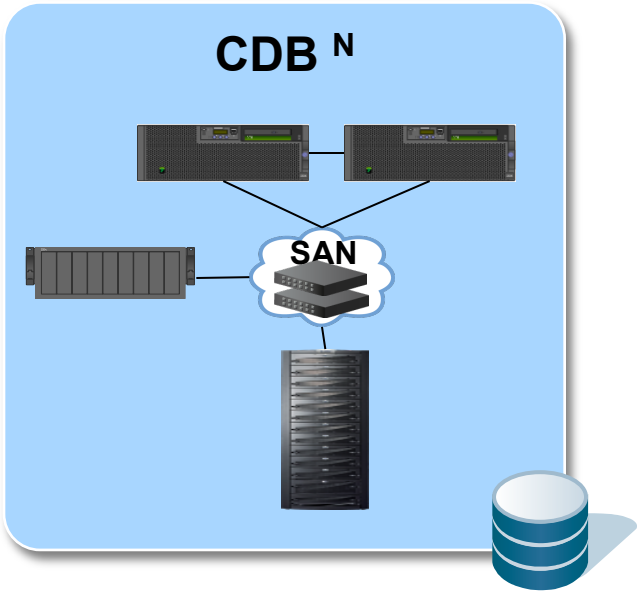


Comverse ONE Architecture | Scalability Model

Customer/Billing Server (CDB)



X # of Accounts

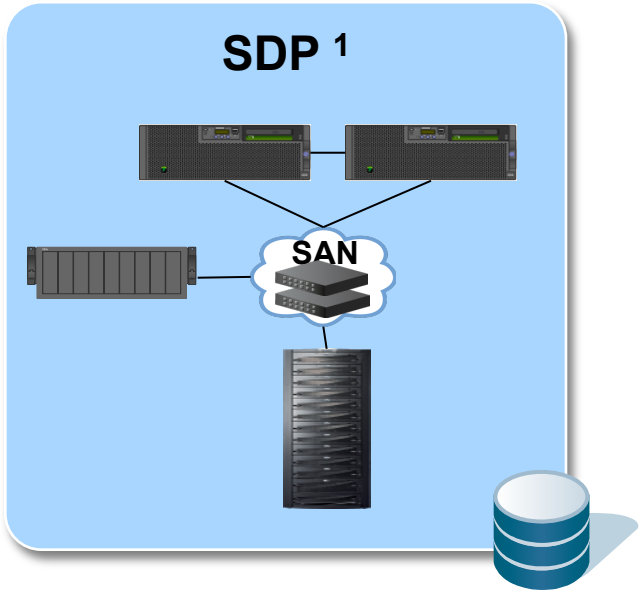


X # of Accounts

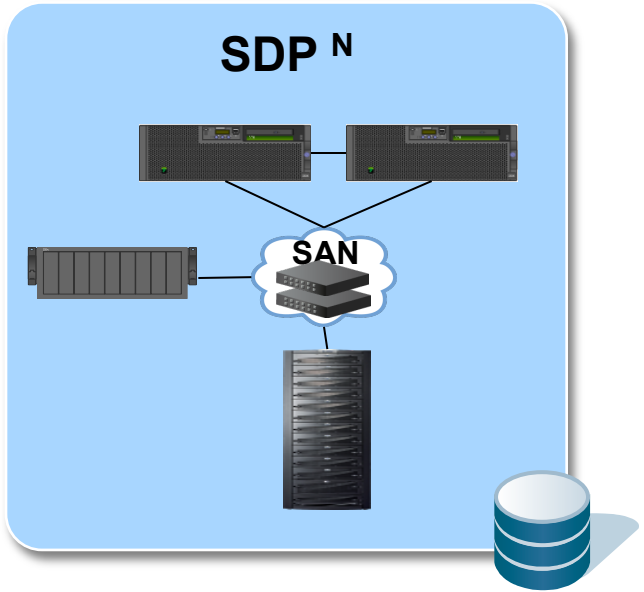
- ✓ Master Data Source for Accounts, Usage, RC/NRC, Financial Summary, etc.
- ✓ Account base is spread across multiple CDB (isolated from each other)
- ✓ Deployed on an Active-Standby HW Domain (i.e. a Physical Server or LPAR)

Comverse ONE Architecture | Scalability Model

Subscriber Data Point (SDP)



X # of Accounts



X # of Accounts

- ✓ Real-Time snapshot of Accounts, Balances, Accumulators, Rated Usage
- ✓ Account base is spread across multiple SDP (isolated from each other)
- ✓ Deployed on an Active-Standby HW Domain (i.e. a Physical Server or LPAR)

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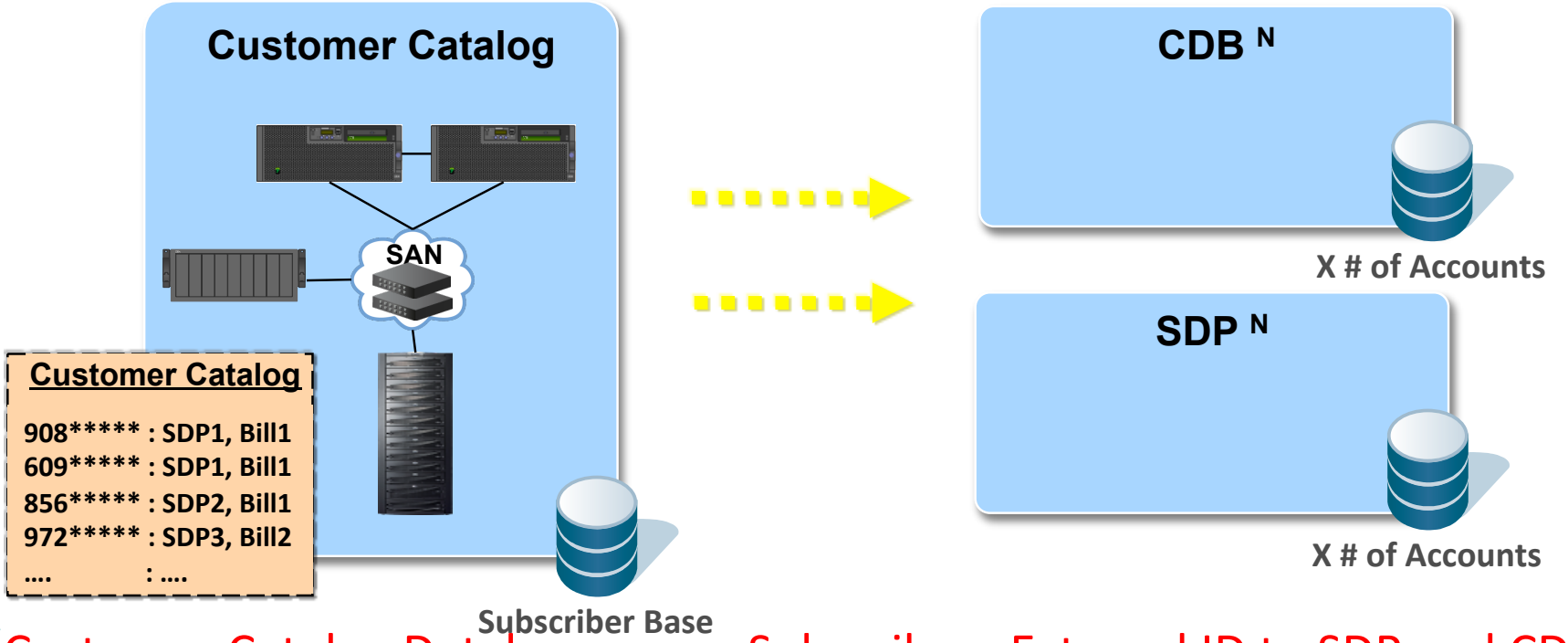
Comverse ONE Architecture | Scalability Model

Customer Catalog Database (CTLG)



- ✓ Customer Catalog Database maps Subscribers External ID to SDP and CDB
- ✓ Processes utilize Customer Catalog to determine the target SDP and CDB
- ✓ Deployed on an Active-Standby HW Domain (i.e. a Physical Server or LPAR)

Comverse ONE Architecture | Scalability Model

Other Key Architectural Building Blocks

- ✓Global Source for definition of Services, Products, Offers, Tariffs, etc.,
- ✓Deployed on an Active-Standby Cluster for Maximum Availability
- ✓PC GUI caters Life Cycle Mgmt. (e.g. Edit, Publish) of Product Catalog
- ✓SDP in Production Environment works off of its local submitted copy

- ✓Global Source for Tracking Arbitrated and Rated CDR/Usage Files
- ✓Deployed on an Active-Standby Cluster for Maximum Availability
- ✓Provides Tracking and Correction of unguided CDR/Usages
- ✓Allows Auditing and Accounting of Rated CDR/Usage Files

- ✓Global Source for Managing Roles and Credentials for all Users
- ✓Deployed on an Active-Standby Cluster for Maximum Availability
- ✓Provides AAA functionality with SARBOX Compliancy
- ✓Captures User Activity Logs for Auditing and Accounting

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Comverse ONE Architecture | Scalability Model

Other Key Architectural Building Blocks

CDR/Usage Formatting

- ✓2N Cluster with Multi-Instance and Multi-threaded Architecture
- ✓Single Cluster per Group of Network Elements or Mediation Devices
- ✓Filters/Formats the incoming CDR to Comverse ONE CDR Format
- ✓Makes the Arbitrated CDR available for Guiding

CDR/Usage Guiding

- ✓N+1 Cluster with Multi-Instance and Multi-threaded Architecture
- ✓Single Cluster per System processing all incoming CDR/Usages
- ✓Uses Customer Catalog to guide CDR/Usage to target Rating Platform
- ✓Updates Audit & Control for tracking all the incoming CDR/Usage files

Offline Charging System

- ✓N+1 Cluster with Multi-Instance and Multi-threaded Architecture
- ✓Single Cluster per SDP for Parallel Streams of Rating Engines
- ✓Rating, Charging & Promotions for CDR/Usage Events (completed)
- ✓Updates Audit & Control as it progresses with the CDR/Usage files

Comverse ONE Architecture | Scalability Model

Other Key Architectural Building Blocks

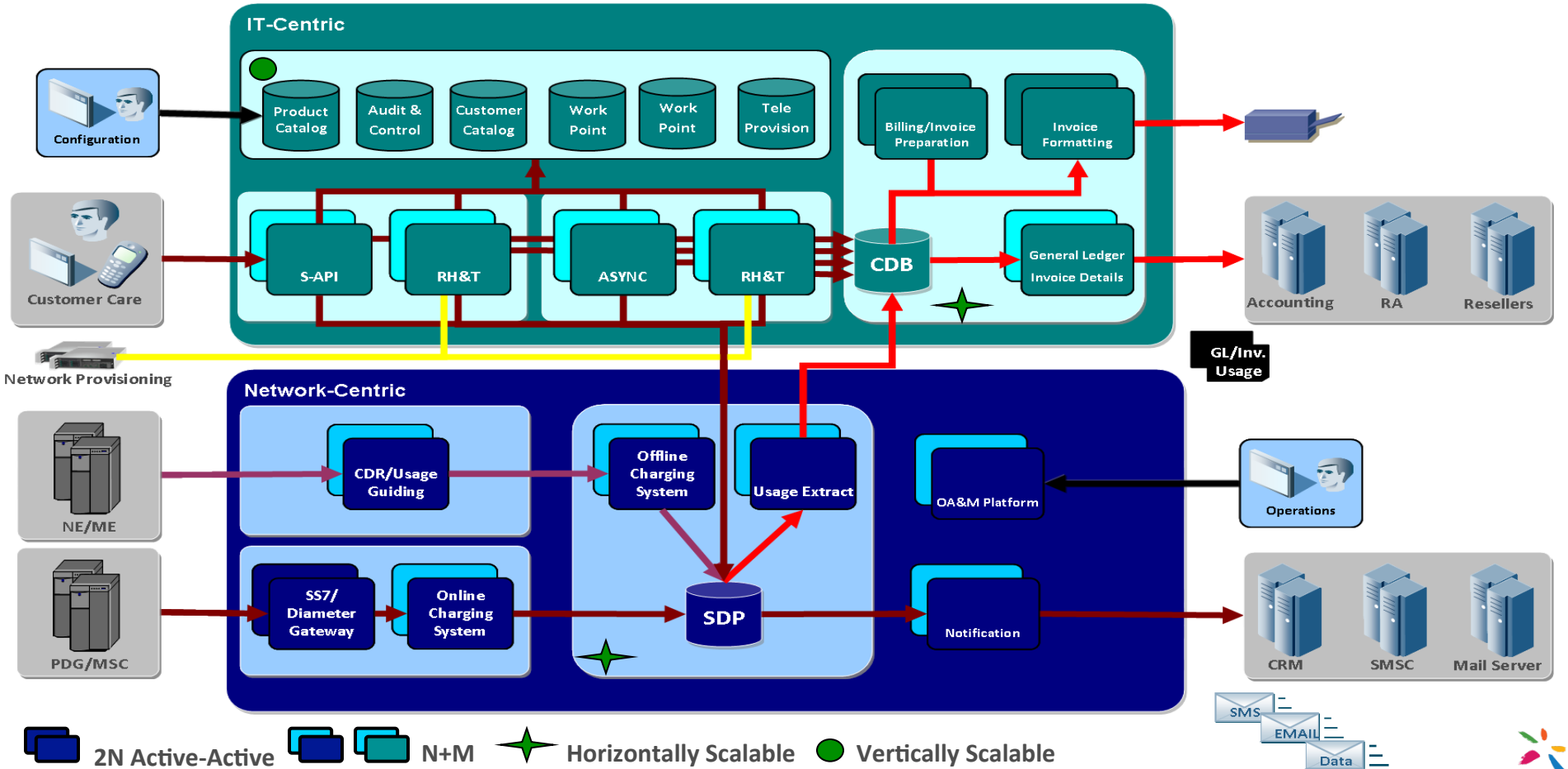
- ✓Multi-Instance and Multi-threaded Processes
- ✓Run on each SDP for Parallel Streams of Usage Extracts
- ✓Periodically extracts the Rated Usage from SDP and transfers to CBS
- ✓Updates Audit & Control for tracking the status of all the CDR/Usages

- ✓N+1 Cluster with Multi-Instance and Multi-threaded Architecture
- ✓A Cluster per CBS for Parallel Streams of Usage Transformation
- ✓Extracts Usage from CBS and transforms to target Business Processes
- ✓Updates Audit & Control as it progresses with the transfer of Usages

- ✓N+1 Cluster with Multi-Instance and Multi-threaded Architecture
- ✓A Cluster per Rating Platform for Parallel Streams of Notifications
- ✓Dequeues Notifications from SDP, Formats and Forwards to Targets
- ✓Supported Targets include SMS (SMPP), email (SMTP) and PCRF (TCP)

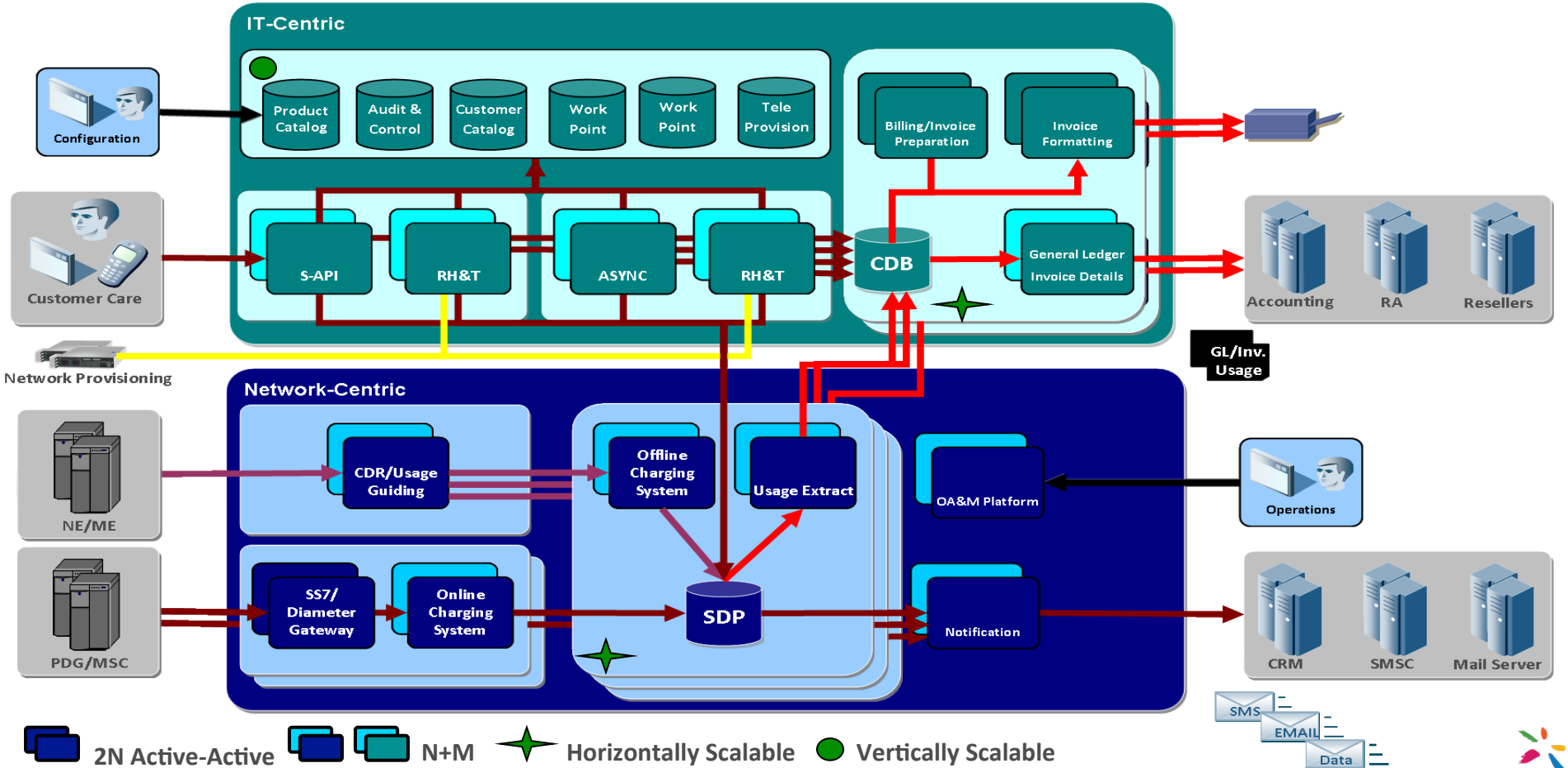
Comverse ONE Architecture | Scalability Model

High Availability with Scalability at Large Scale



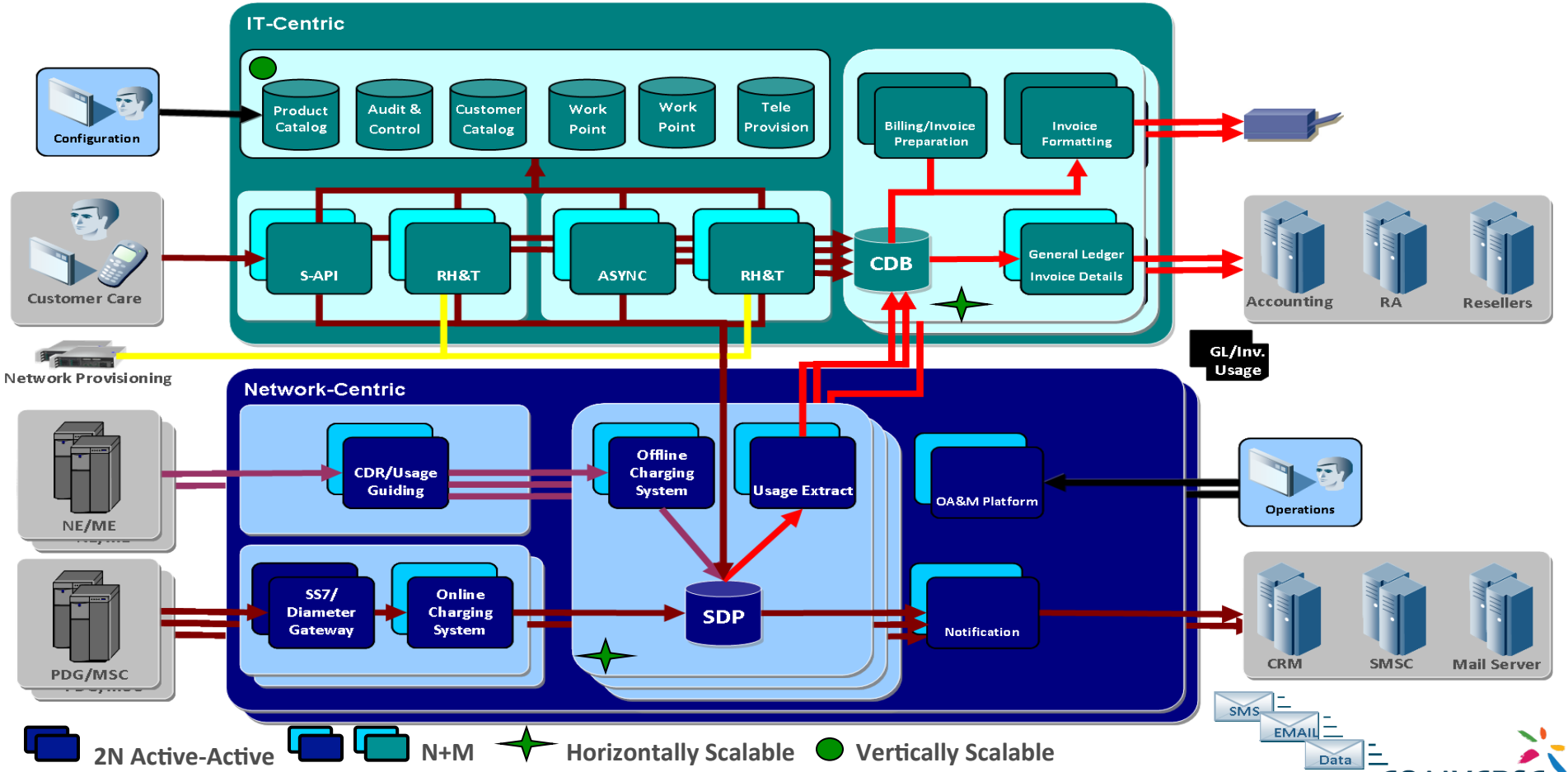
Comverse ONE Architecture | Scalability Model

High Availability with Scalability at Large Scale

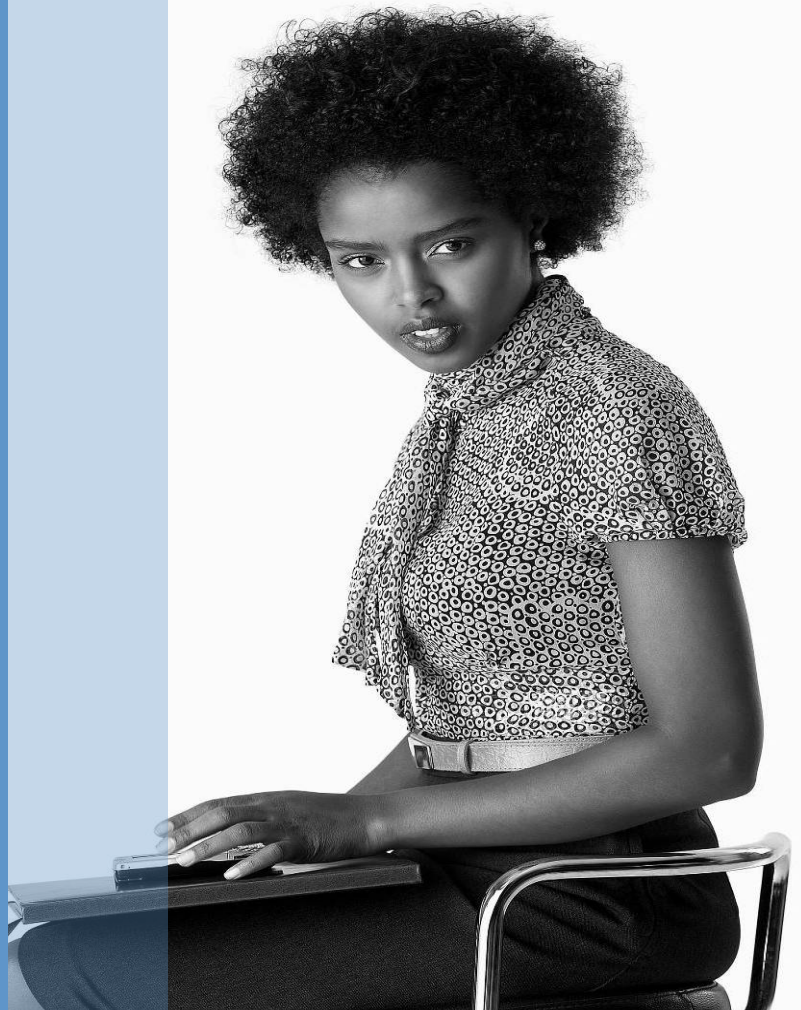


Comverse ONE Architecture | Scalability Model

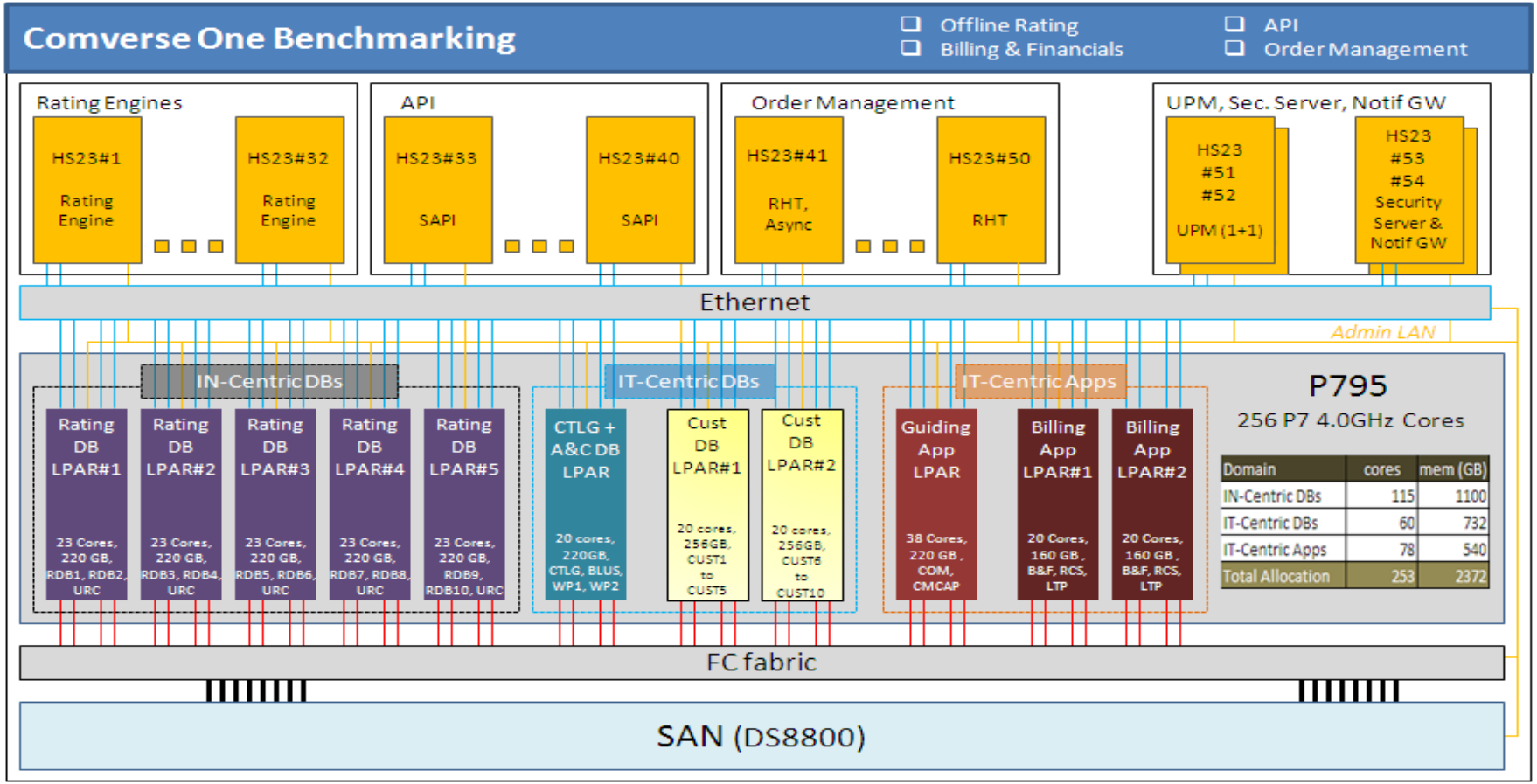
Multi-Site IN Systems with a Centralized Billing System



Performance



Post-Paid Benchmarking – Environment



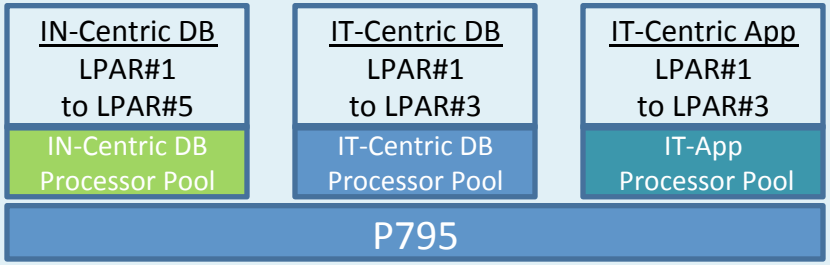
- IN-Centric DBs, IT-Centric DBs & IT-Centric Apps on AIX on P795 Platform
- Rating Engines, API Servers, Order Management Servers on Linux on HS23 Blades
- UPM App, Security Server, Notification Gateway Apps on Linux on HS23 Blades

Post-Paid Benchmarking – Workload Distribution

LPAR Layout				
LPAR Description			Cores	mem. (GB)
IN-Centric DB LPARs			**115**	**1,100**
	LPAR#1	RatingDB1, RatingDB2, UPM DBs	23	220
	LPAR#2	RatingDB3, RatingDB4	23	220
	LPAR#3	RatingDB5, RatingDB6	23	220
	LPAR#4	RatingDB7, RatingDB8	23	220
	LPAR#5	RatingDB9, RatingDB10	23	220
IT-Centric DB LPARs			**60**	**732**
	LPAR#1	Customer Catalog DB, A&C DB	20	220
	LPAR#2	CustDB1 .. CustDB5	20	256
	LPAR#3	CustDB6 .. CustDB10	20	256
IT-Centric Apps LPARs			**78**	**540**
	LPAR#1	Guiding Application	38	220
	LPAR#2	B&F Application	20	160
	LPAR#3	B&F Application	20	160
Total Allocation on P795 Platform			253	2,372

AIX Workload on P795 Platform

- All IN-Centric DB LPARs are part of one Processor Pool
- All IT-Centric DB LPARs are part of one Processor Pool
- All IT-Centric App LPARs are part of one Processor Pool



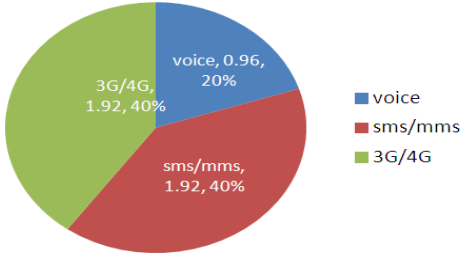
Linux Workload on HS23 Blades

- Multiple Application instances installed on each HS23 Blade (where applicable)

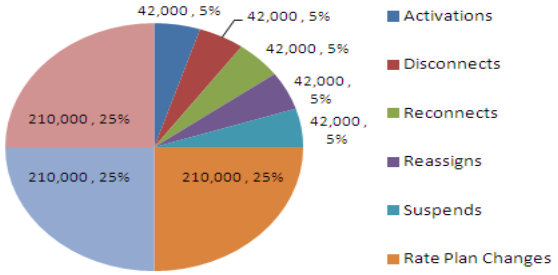
HS23 Allocation	
Description	# of HS23 Blades
Rating Engines (n+1)	32
SAPI (API) Servers (n+1)	7
Order Management Servers (n+1)	10
UPM Application Server (1+1)	2
Security Servers (n+1)	2
Notification Gateway Servers (n+1)	2
Total HS23 Blades	55

Post-Paid Benchmarking – Traffic Profile

Traffic Profile -- Offline Rating	
CDRs per Subscriber per Busy Hour	4.8
Number of Busy Hours per Day	10
Number of Rating Events per CDR	1
Number of CDRs per File	100,000
Number of CDR Files received from Network per Day	50,400
Number of Rating Events per Busy Hour	504,000,000
Number of Rating Events per Day	5,040,000,000



Traffic Profile -- API	
# of CSRs	5,250
# of API invocations from CSR UIs per Busy Hour	315,000
# of API invocations from ESB Applications	525,000
Total # of API invocations per Busy Hour	840,000

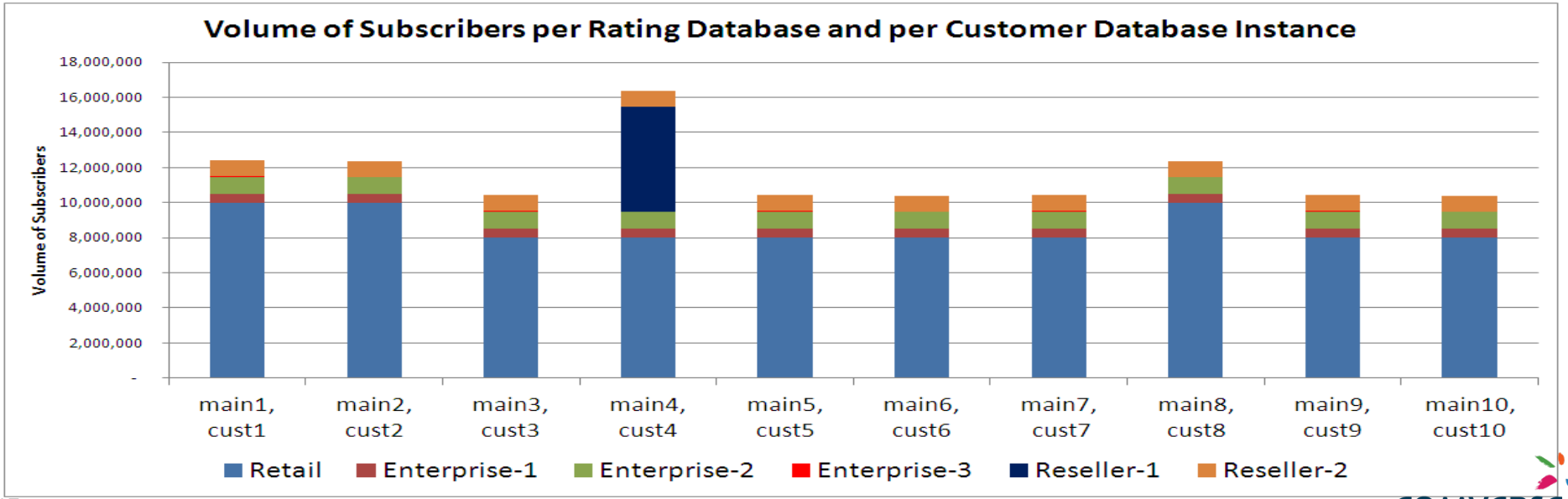


Traffic Profile -- Orders	
% of Simple Orders (~5 DB Tx per Order Workflow)	60%
% of Complex Orders (~15 DB Tx per Order Workflow)	25%
% of Very-Complex Orders (~50 DB Tx per Order Workflow)	15%
Number of Orders per Busy Hour	250,155

Post-Paid Benchmarking – Account & Subscribers

AccountType	# of Accounts	# of Subscribers per Account	# of Subscribers
Retail	17,200,000	5	86,000,000
Enterprise-1	10,000	500	5,000,000
Enterprise-2	3,250	3,000	9,750,000
Enterprise-3	5	50,000	250,000
Reseller-1	1	6,000,000	6,000,000
Reseller-2	900	10,000	9,000,000
Total Accounts:	**17,214,156**	**Total Subscribers:**	**116,000,000**

- **Active Subscribers:** 105,000,000 (91% of 116,000,000)
- **Subscriber Profile:**
  - Three Inventory Items
  - Five Balances
  - Four Accumulators
  - Two Recurring Charges per Month



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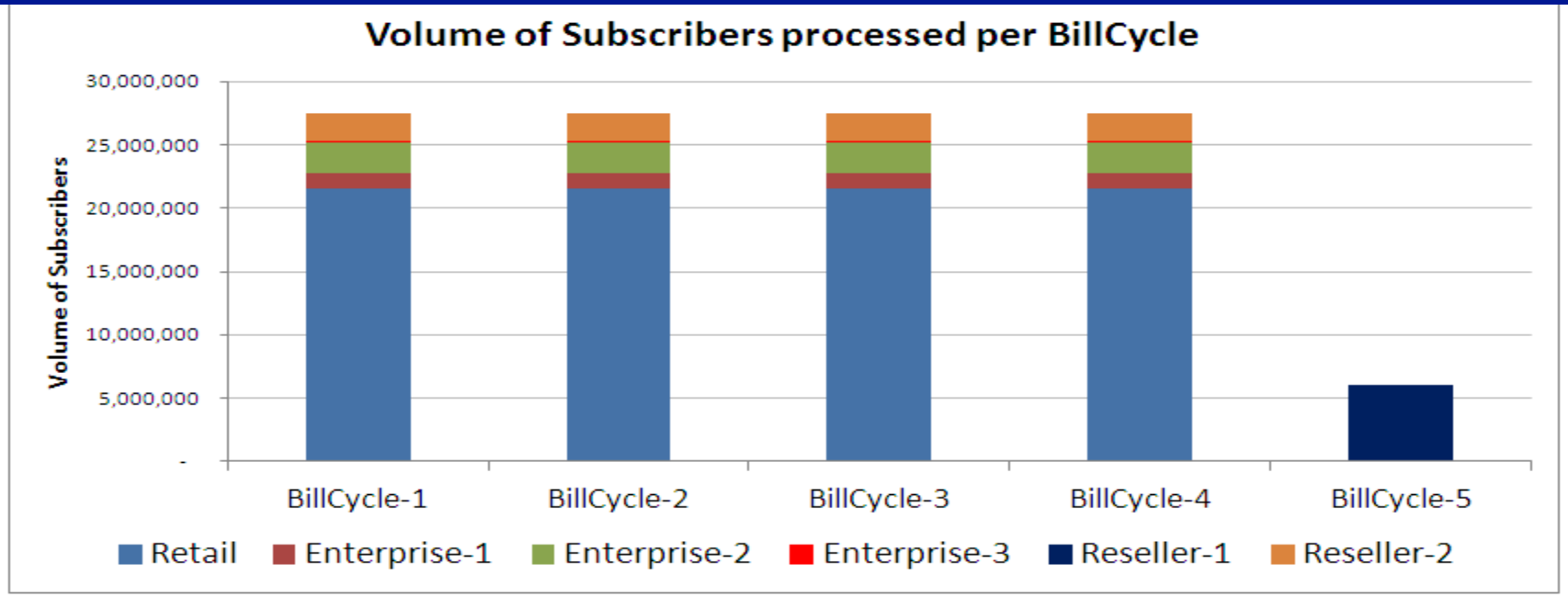
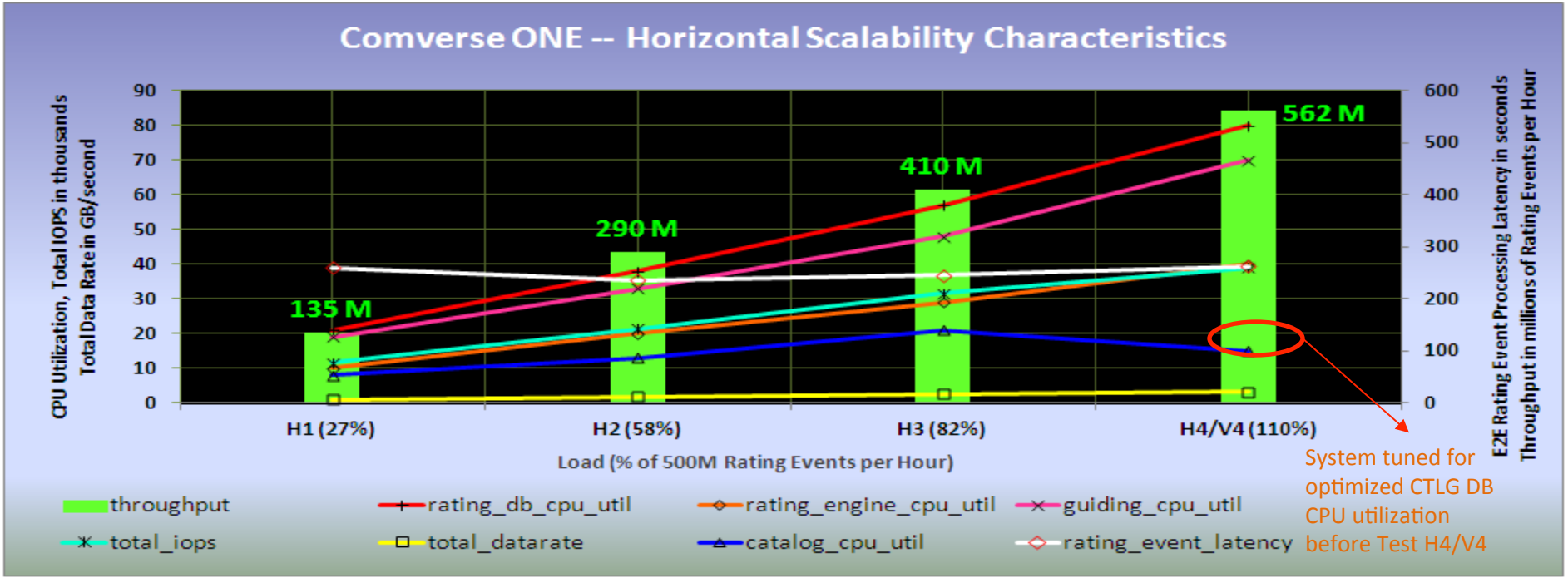
Post-Paid Benchmarking – Bill Cycle



BillCycle	BillCycle-1	BillCycle-2	BillCycle-3	BillCycle-4	BillCycle-5
Total Subscribers processed per BillCycle	27,487,500	27,487,500	27,487,500	27,487,500	6,050,000

- Number of Bill Cycles: 5
- Duration of each Bill Cycle: 16 hours (8 hours for Invoice Generation and 8 hours for Invoice Formatting)
- Reseller-1 Account (6M subscribers per account) to be processed in dedicated Bill Cycle (BillCycle-5)

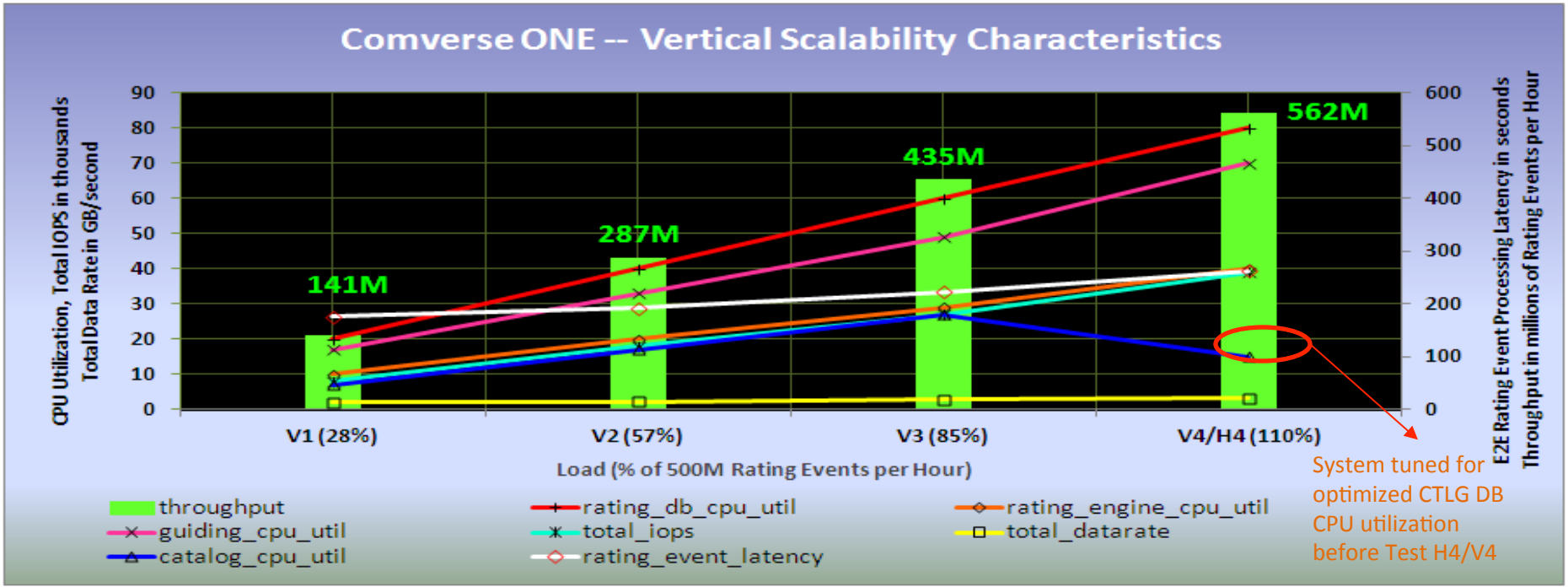
Post-Paid Benchmarking – Scalability Results



- Objective of Horizontal Scalability Tests is to characterize the System behavior as the Volume of Account-Subscribers grow over a few months or years. This simulates a real world customer growing it's subscriber base over time. Full load per subscriber is generated for all Subscribers used for each Test Case.

✓ Linear Scalability with Deterministic Resource Utilization and Throughput
✓ Avg. End-to-End Rating Event Processing Latency at 100% Capacity is < 5 minutes

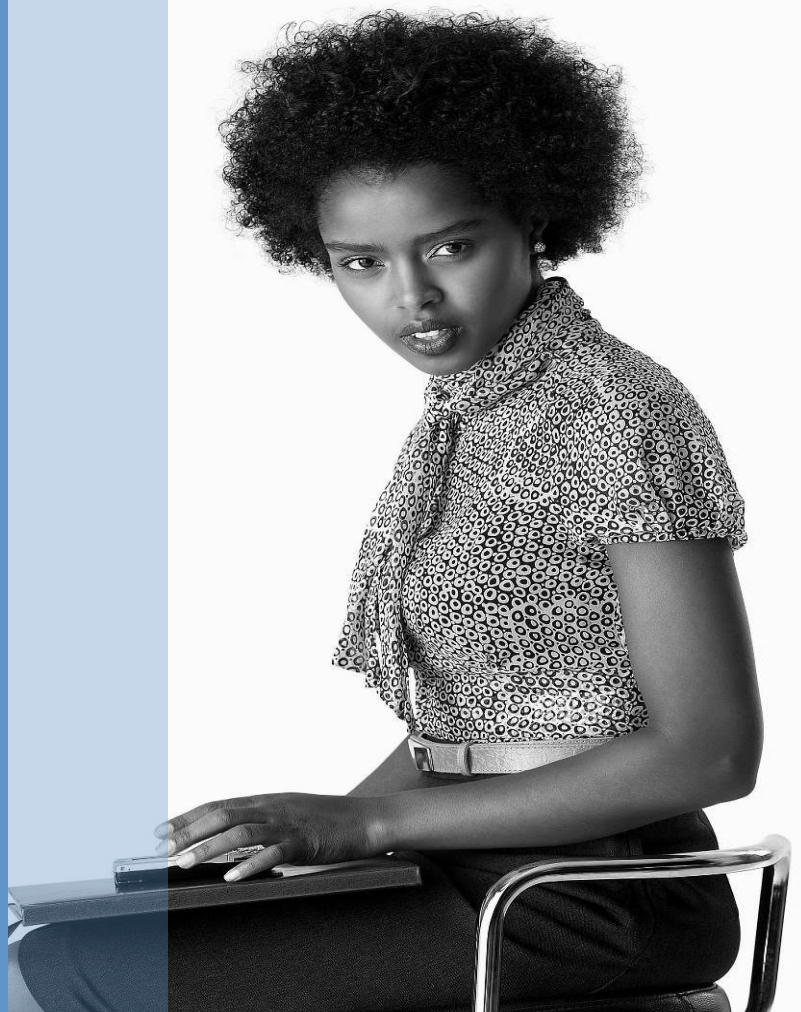
Post-Paid Benchmarking – Scalability Results



- Objective of Vertical Scalability Tests is to characterize the System behavior as the Volume of Usages grow over the course of the day. This simulates a real world peak and off-peak traffic conditions in the customer's environment. Entire range of active subscribers (105M) are used for each Test Case and the Usage Volume per Subscriber is varied

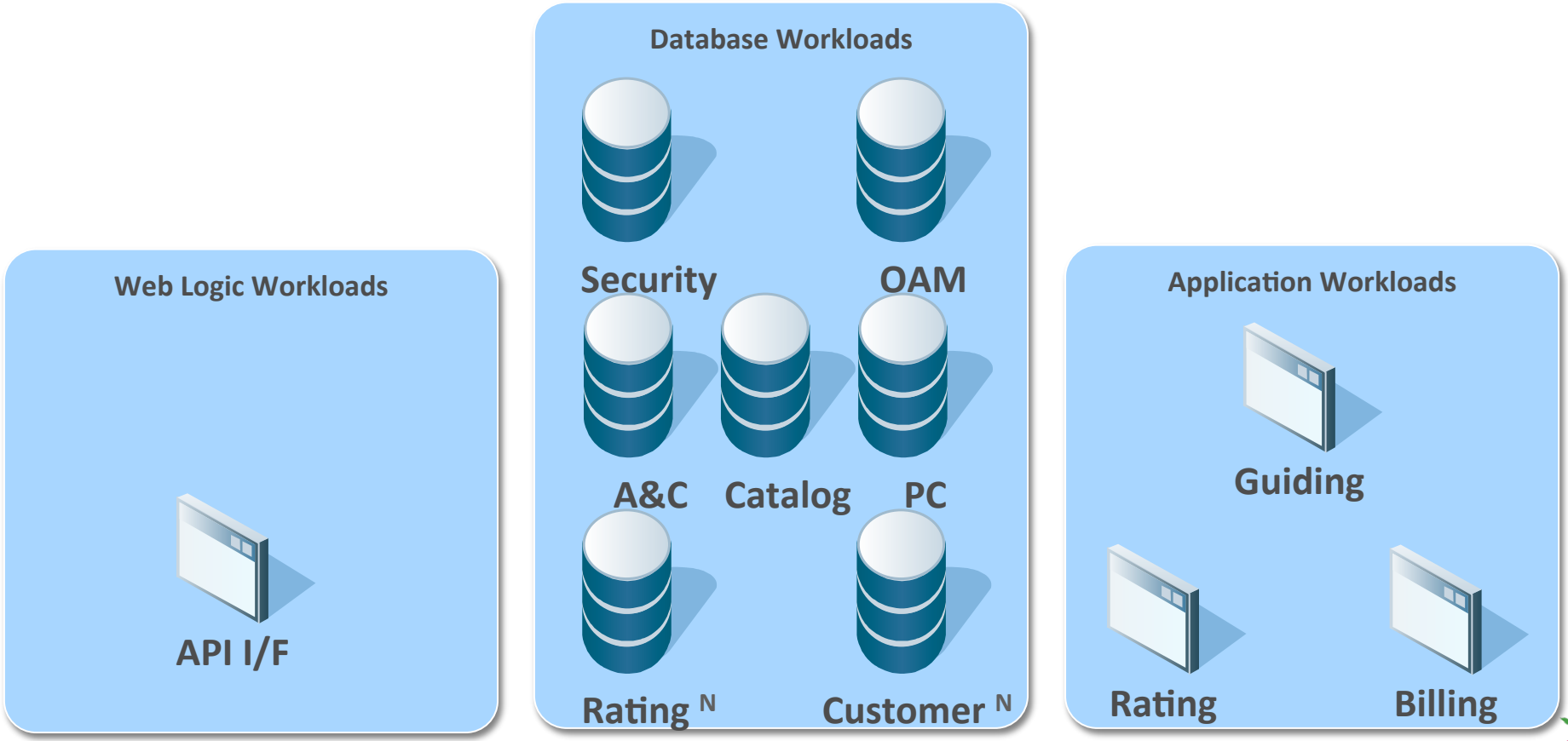
✓ Linear Scalability with Deterministic Resource Utilization and Throughput
✓ Avg. End-to-End Rating Event Processing Latency at 100% Capacity is < 5 minutes

Platform Architecture



Comverse Approach to Oi Platform

Comverse ONE Workloads for Oi Billing System (Post-Paid)



Comverse Approach to Oi Platform

Hardware Platform

- *Oi can procure the HW Platform and 3P SW Licenses based on Comverse Sizing Guidelines (CPU, Memory, Storage, etc.)*

- *Comverse ONE Platform may be shared by other IT workloads, if additional capacity available; if appropriate, Comverse ONE database and application domains can also be deployed on an existing IT Infrastructure that is shared with other IT Workloads*

- *Comverse ONE can be deployed on a Scale Up and Scale-Within Platform – multiple workloads on a Scalable Monolithic Platform with required CPU and Memory*

- *Comverse ONE can also be deployed on a Scale-Out Architecture – workloads across multiple physical platforms, each with part of the required CPU/Memory resources*

Comverse would assist Oi to design the HW Platform as per Oi's Preference; Oi could procure HW directly from vendors of their choice

Comverse Approach to Oi Platform

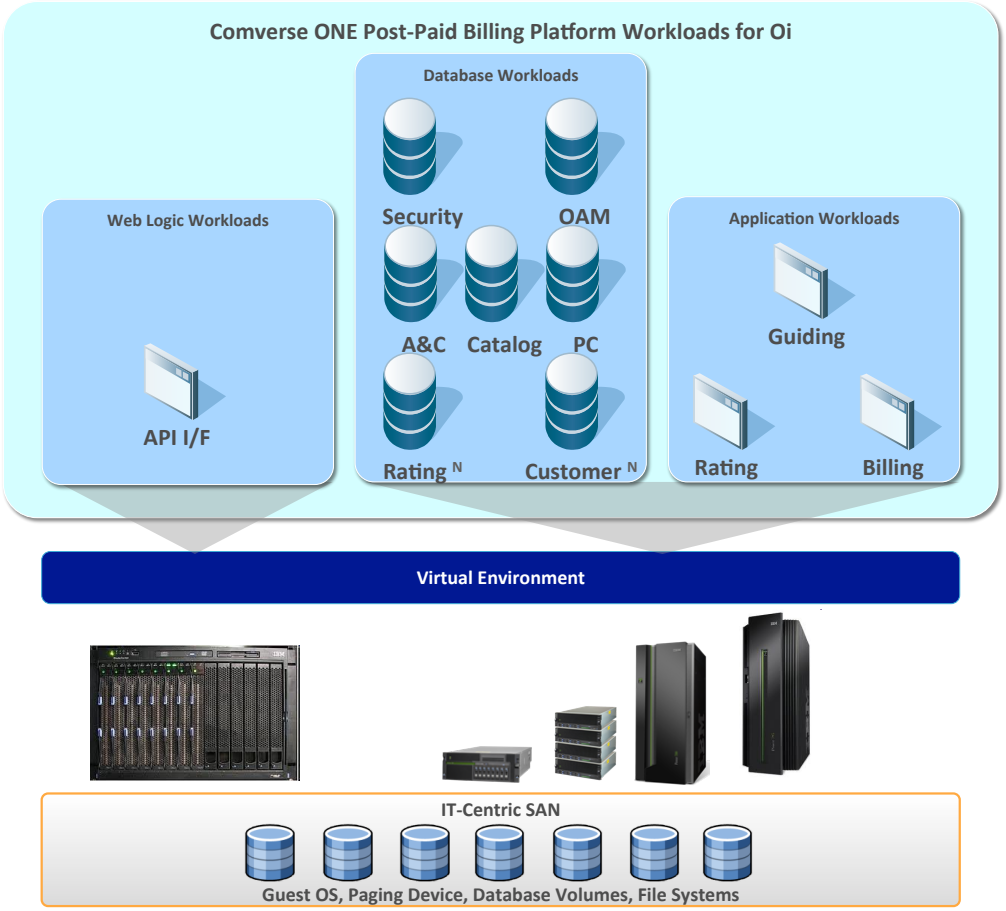
Server Consolidation and Virtualization

- *Consolidating variety of workloads into fewer servers, and taking advantage of virtualization allows dynamically sharing processing resources*
- *Sharing Resources through intelligent virtualization enables high utilization which, in turn, reduces cost; Resource sharing drives down the wasted capacity in the system by using it for other workloads.*
- *Partitions can be easily resized and created in response to the need; allows flexibility to respond to unexpected business events – Partitions can instantly tap into additional resources as required and subject to defined priorities of Workloads*
- *Allows Workloads to Scale-Out within a virtualized, consolidated, energy efficient infrastructure; allows Workloads those do not lend themselves to distributed processing to benefit from a Scale Up Architecture;*

Server Consolidation and Intelligent Virtualization significantly reduces the TCO while maximizing the ROI on IT Infrastructure

Comverse Approach to Oi Platform

Virtualized Comverse ONE Platform for Oi Billing System (Post-Paid)



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Comverse Approach to Oi Architecture

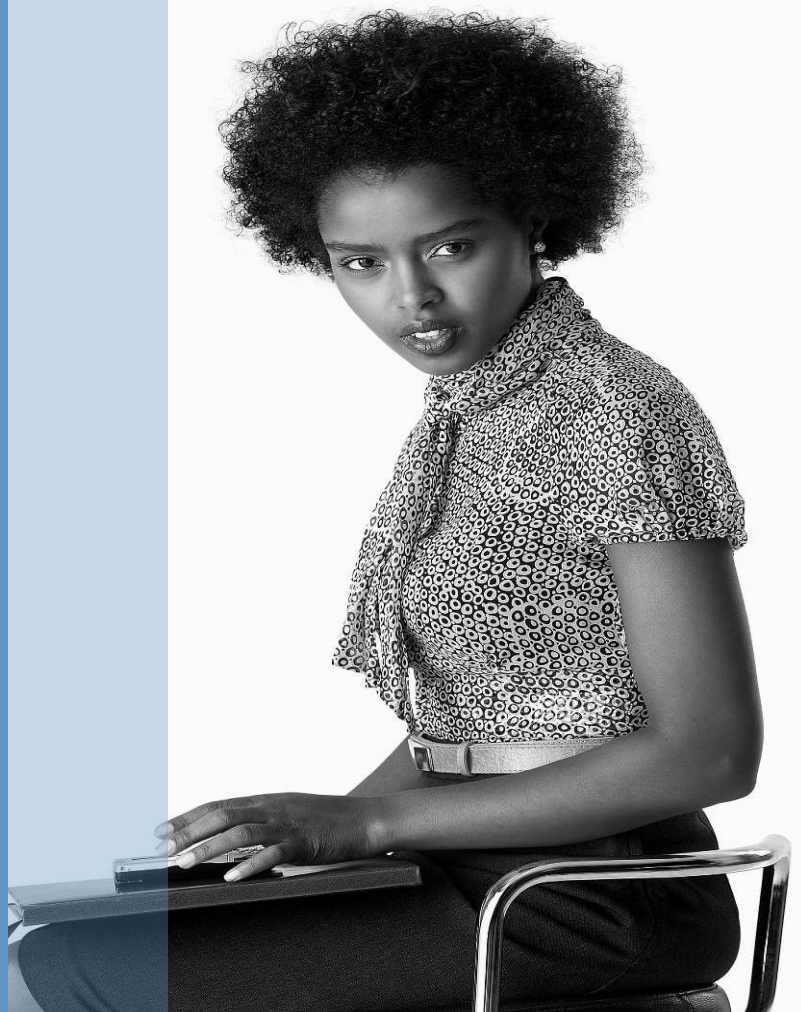
Key Takeaways

Comverse ONE Architecture is highly flexible; built on modern technologies and platforms; complies with current Industry's best practices and standards; adopts to Oi's preferred IT standards

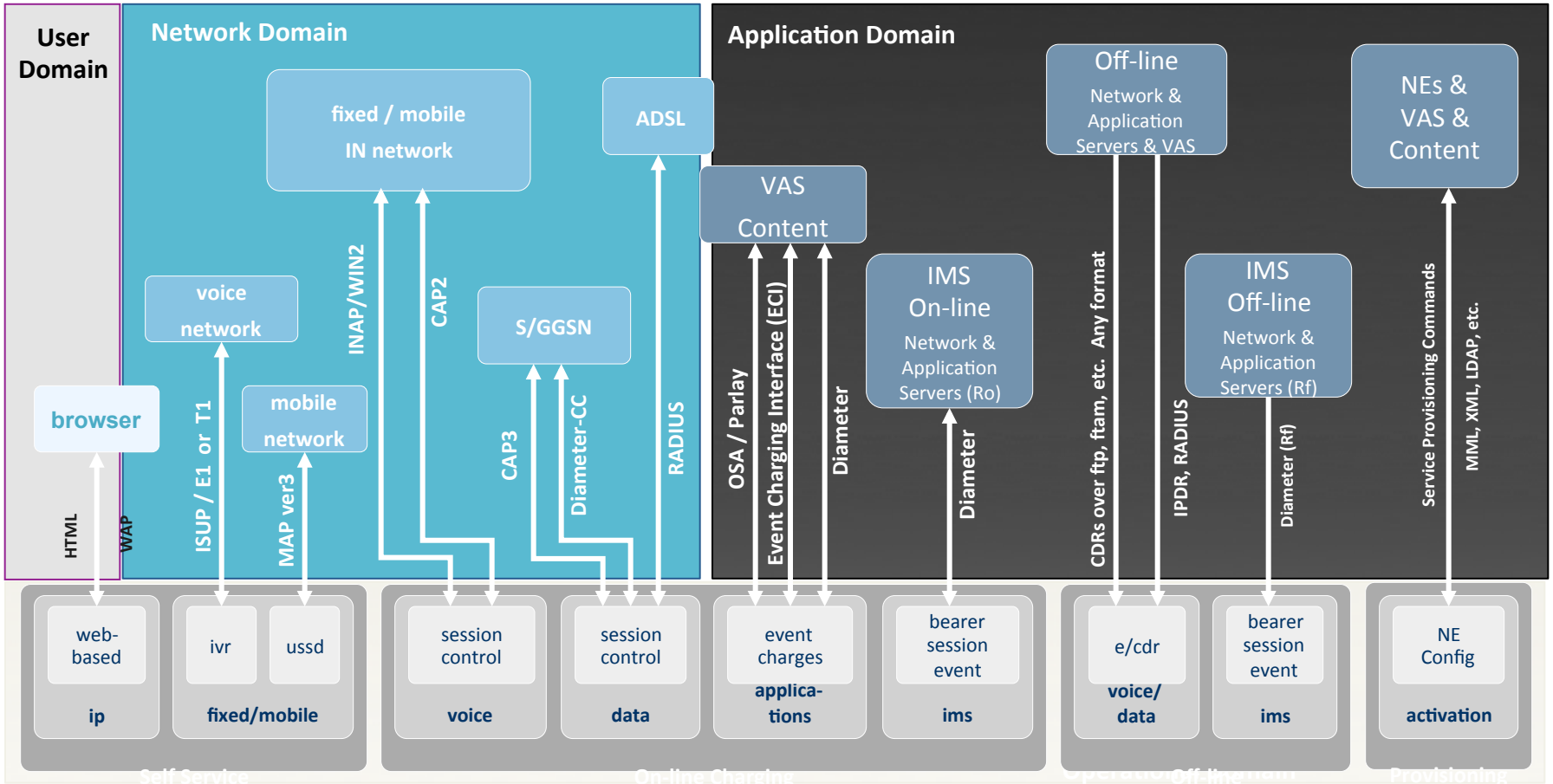
Comverse ONE Solution to Oi can be deployed on a virtualized infrastructure with dynamic resource optimization to achieve maximum resource utilization with uncompromised Availability

Comverse jointly with Oi would design (during IPA phase) the computing and storage infrastructure that suits Oi's Business needs (now and going forward) and optimized for effective TCO

Oi Ecosystem Integration



Interfaces to Networks and Applications



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Integration Points with Oi IT Ecosystem

Tailored Integrations

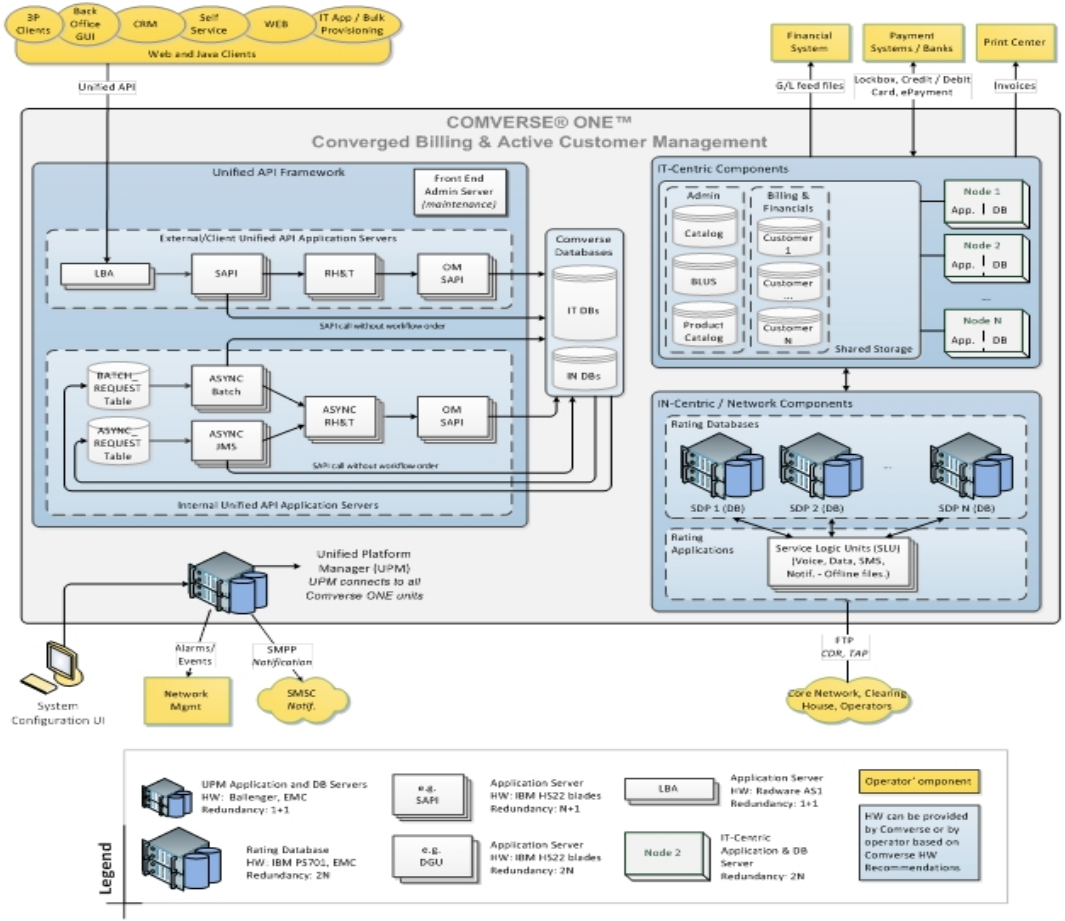
- Typically one off integrations performed during installation

Data Extracts

- Used for data storage and 3rd party data processing
- Comverse will provide extract mechanism to send data downstream

APIs

- Used on a more on-going basis for new applications
- Comverse has a standard set of open APIs



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Integration Points with Oi IT Ecosystem

Single API Construct (i.e. Web Services / SOAP I/F)

subscriberAddOfferInstance – adds an offer to a subscriber

- *SubscriberRetrieve* – retrieves subscriber data
- *AccountRetrieve* – retrieves account data
- *OrderNew* – used to set up the order
- *OrderCreate* - used to set up the order
- *OfferInstanceNew* – sets up an instance of the offer being added
- *SubscriberContextValidate* – validates inputs/changes
- *offerExtIdCoreqConsolidatedFind* – checks for offer/external ID compatability
- *subscriberServiceabilityValidate* – validates subscriber can receive offer
- *subscriberCollectionInitialize* – sets up the list of accumulators, balances, RCs and NRCs for the new offer
- *subscriberUpdateSave* – makes the final database save

Example of a high-level API built from low-level APIs

Integration Points with Oi IT Ecosystem

Single API (i.e. Web Services / SOAP I/F)

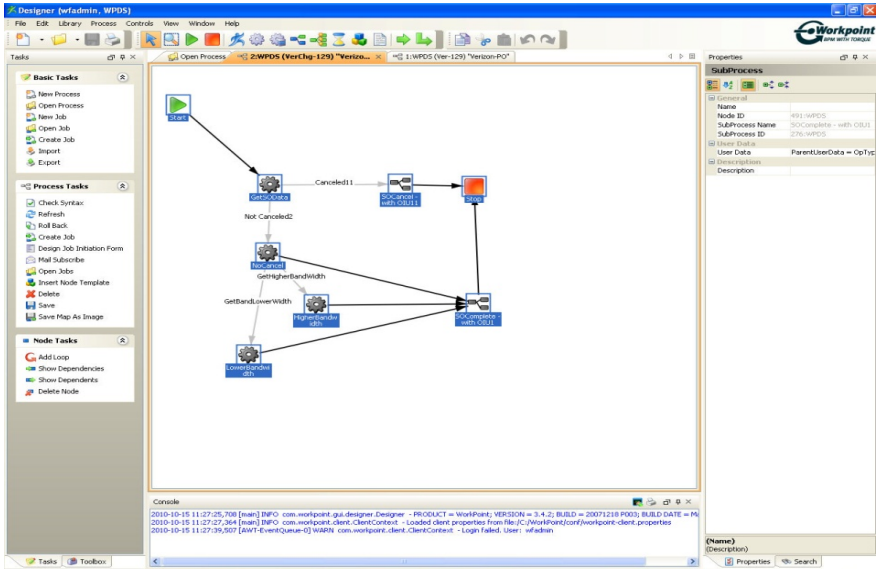
- *Thousands of low-level APIs act as building blocks to construct higher level APIs (a façade layer)*
- *Low-level APIs act as integration points to access core software objects and data model*
- *Existing high-level APIs are provided to meet most operator needs, however,*

Oi can construct your own high-level APIs as required.

Integration Points with Oi IT Ecosystem

Workflows

- *Used for service fulfillment and provisioning, billing cycles, product catalog propagation, any business process workflows*
- *Triggered via SAPI methods*
- *Triggered via events in the Rating Engine*
- *Monitored and managed at the unified platform manager*



Oi can modify or build and execute your own workflows

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Integration Points with Oi IT Ecosystem

Notifications

- *Notifications are triggered upon reaching thresholds*
- *Can easily be integrated to any existing Oi outbound gateways*

System/Service notifications

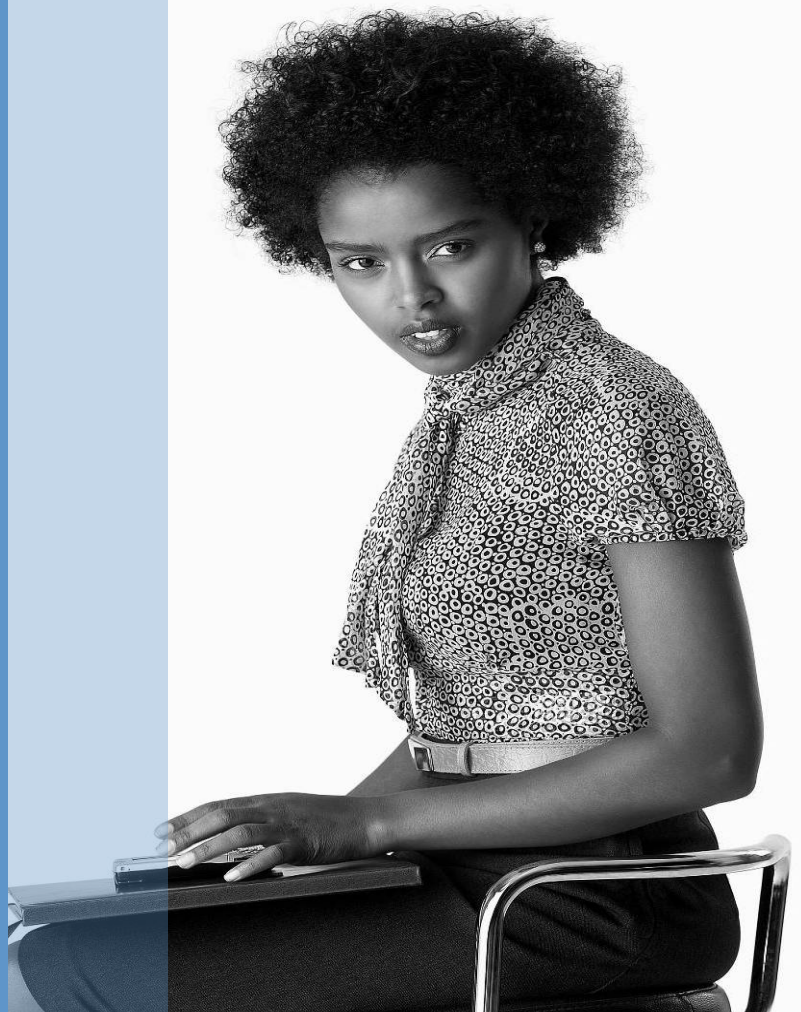
- **Account status**
- **Low balance / No balance**
- **Balance expiration**
- **Recurring Charge/ Charge activity**
- **Recharge confirmation**

Promotional notifications

- **Congratulations**
- **Usage incentives**
- **Recharge incentives**
- **Education**
- **New / Additional services**
- **Usage awards**
- **Loyalty**

Notifications can be SMS/USSD or to an external Oi Application

Additional Information



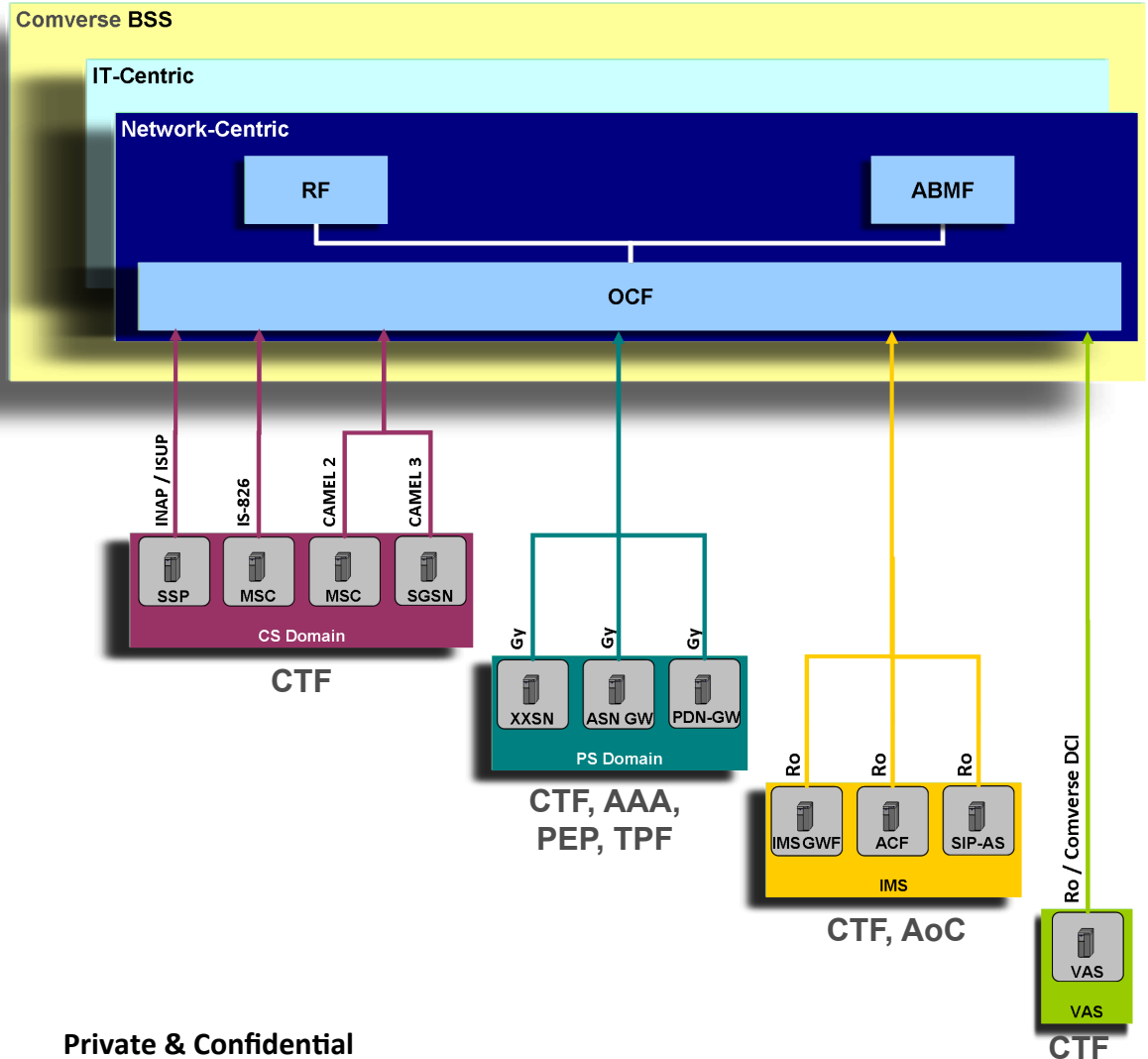
Comverse ONE Architecture | IN-Centric

OCF Compliance

3GPP TS 23.125
3GPP TS 23.251
3GPP TS 32.240
3GPP TS 32.299
3GPP TS 32.260

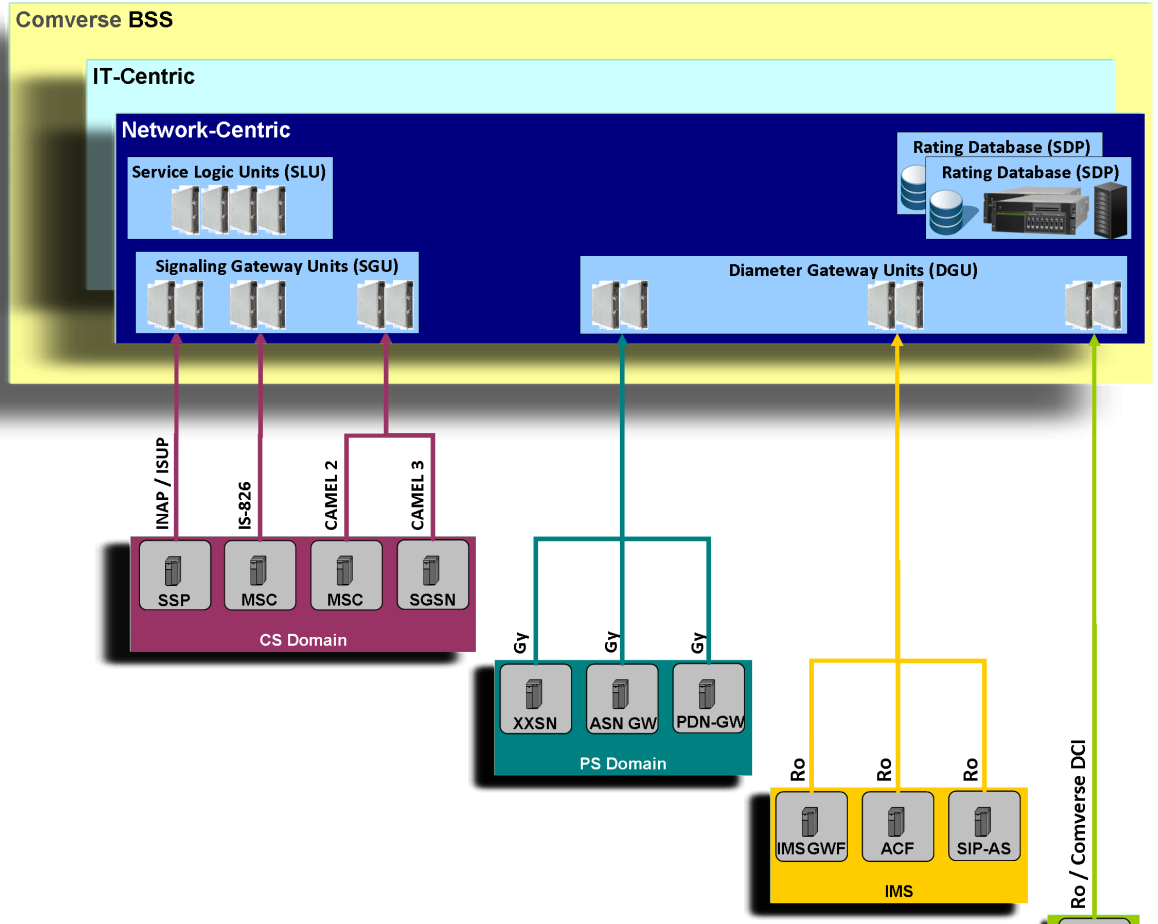
Bearer/Service/Network:
- ✓ Fixed Line
- ✓ CDMA
- ✓ GSM
- ✓ 3G Packet Data Network
- ✓ WIMAX (Adaptation Reqd.)
- ✓ LTE (Adaptation Reqd.)
- ✓ IMS (SIP-AS, IMS-GW, S-CSCF, AoC)
- ✓ VAS (Adaptation Reqd.)
- ✓ Apps / Content (Adaptation Reqd.)

Charging Capabilities:
- ✓ Event based Charging
- ✓ Content based Charging
- ✓ Time / Volume based Charging
- ✓ QoS based Differential Charging
- ✓ APN based differential Charging
- ✓ Location based Charging



Comverse ONE Architecture | IN-Centric

Physical View



Disclaimer: *separation of DGU for each Network is for illustrative purpose only; they can be combined in any combination of Network or they can be kept separate*

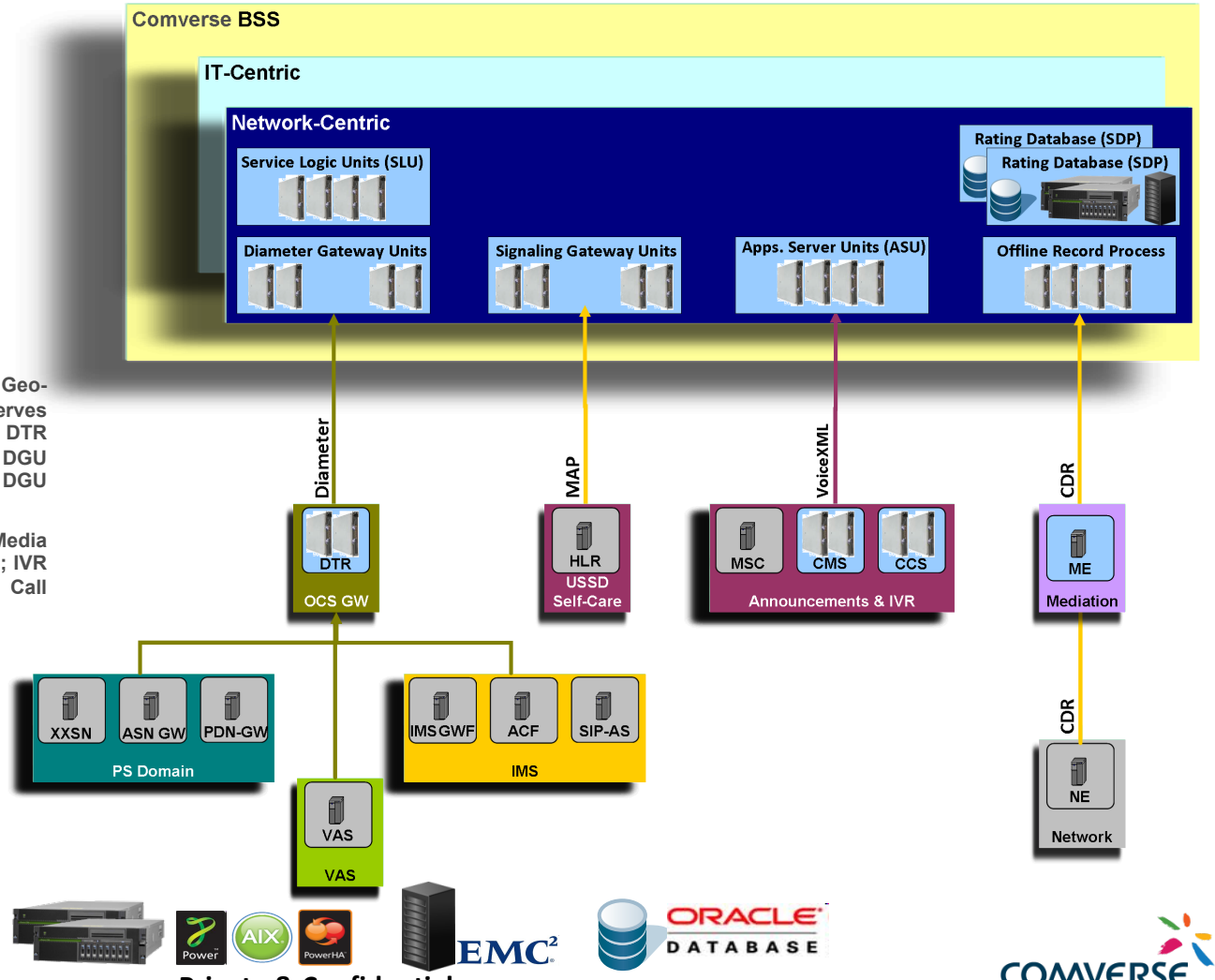
Comverse ONE Architecture | IN-Centric

Physical View

Disclaimer:

In a Multi-Site Deployment (Distributed Systems or Geo-Redundant), Comverse Diameter Traffic Router (DTR) serves as equivalent of an STP in the Signaling Network. The DTR maintains Subscribers Range Map corresponding to all DGU across all sites, and routes the traffic to the appropriate DGU based on where the Subscriber data is currently online

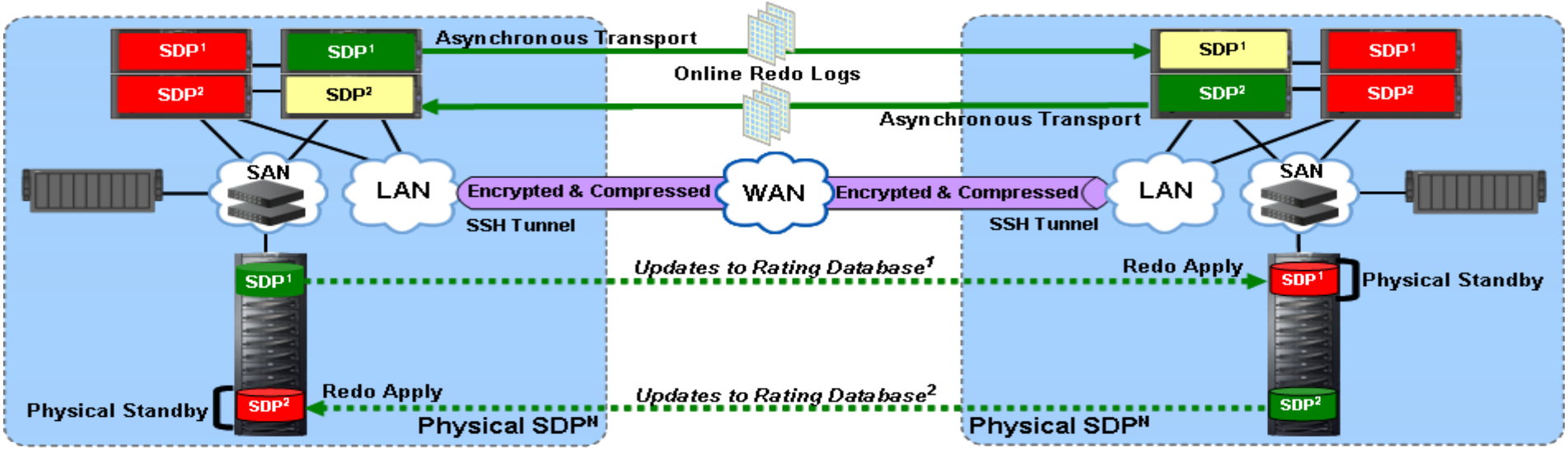
Comverse Call Control Server (CCS) and Comverse Media Server (CMS) together serves as the Intelligent Peripheral; IVR Prompts are distributed along with the CMS; the IVR Call Flows are implemented by ASU



COMVERSE

Geographically Redundant SDP Architecture

SDP Database Replication on Logical Partitions

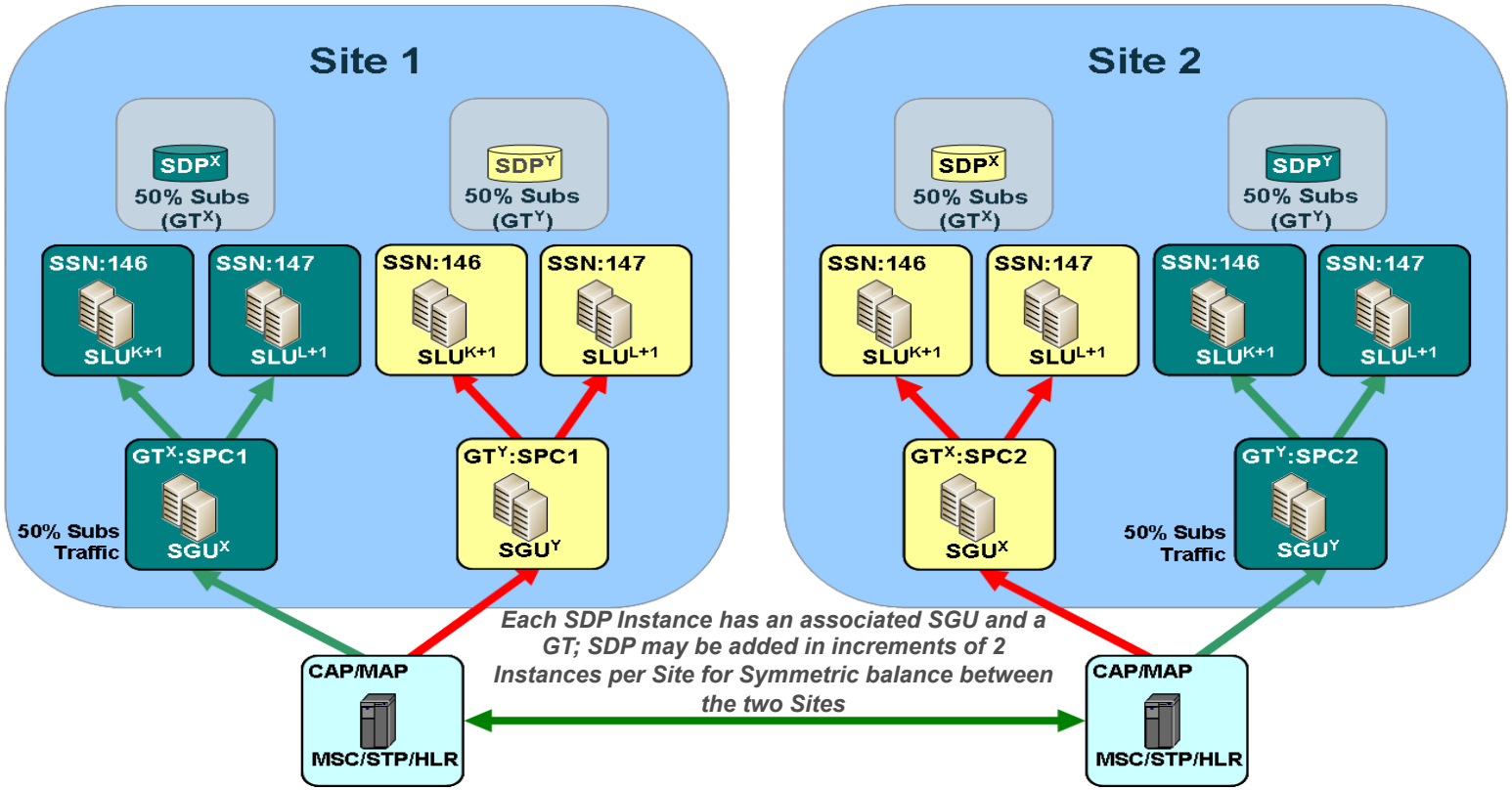


History Partitions are exported as Data Pump dump files that are compressed and sent to remote SDP, and managed in the History Backup File System
History Databases on the Remote SDP are re-created during recovery, and the Data Pump dump files are uncompressed and imported

- Each Physical SDP is split into SDP^X & SDP^Y : Active – Physical Standby Instances
- All Active Instances are typically sized for, and runs at 50% of the Physical SDP Capacity
- All Standby Instances are sized to function at 50% of the Physical SDP Capacity

Geographically Redundant SCP Architecture

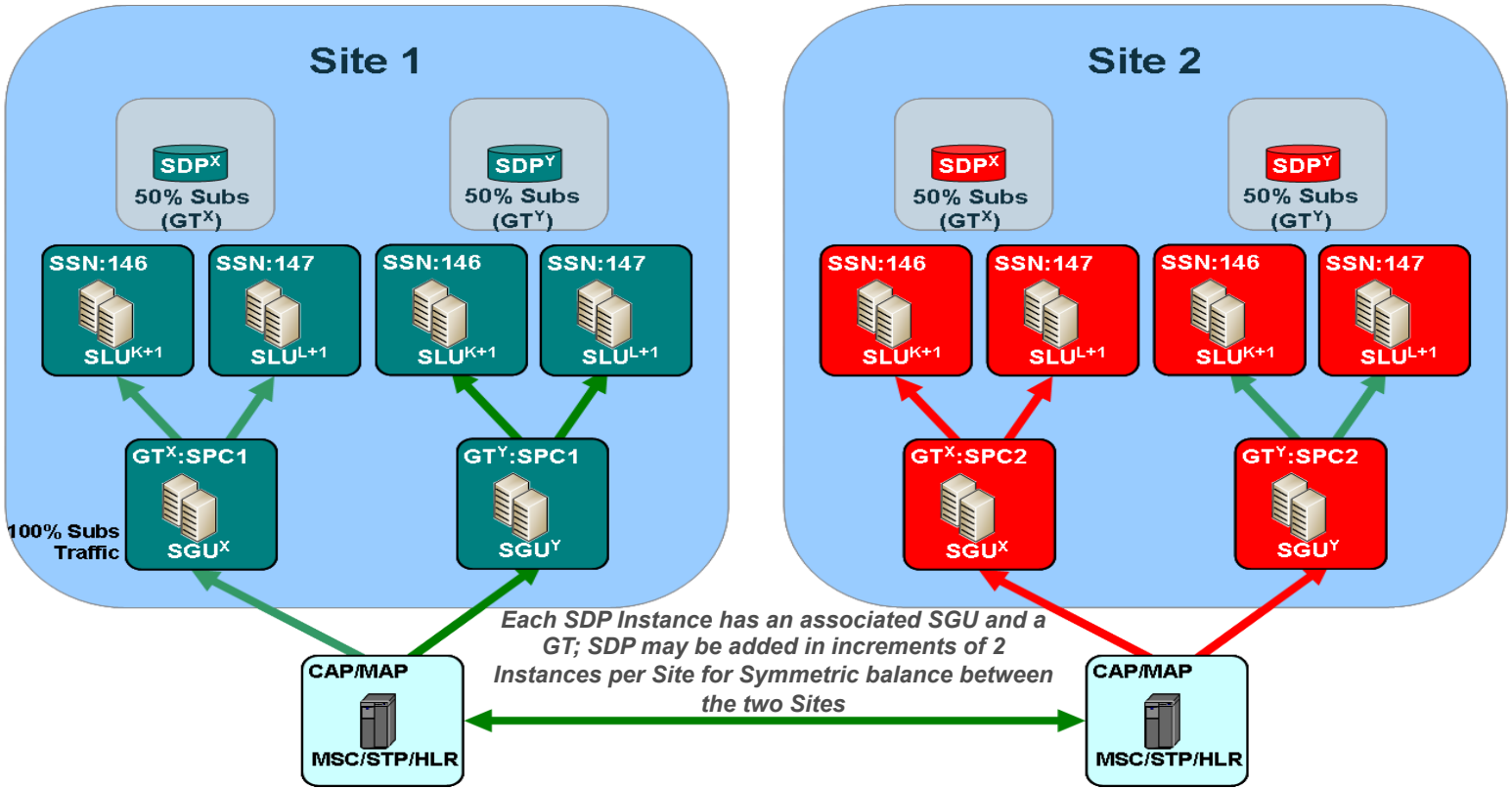
Under Normal Conditions:
100% Subscribers Availability with 100% Traffic Capacity



Network Traffic is uniformly distributed between Sites

Geographically Redundant SCP Architecture

In the event of a disaster:
100% Subscribers Availability with 100% Traffic Capacity

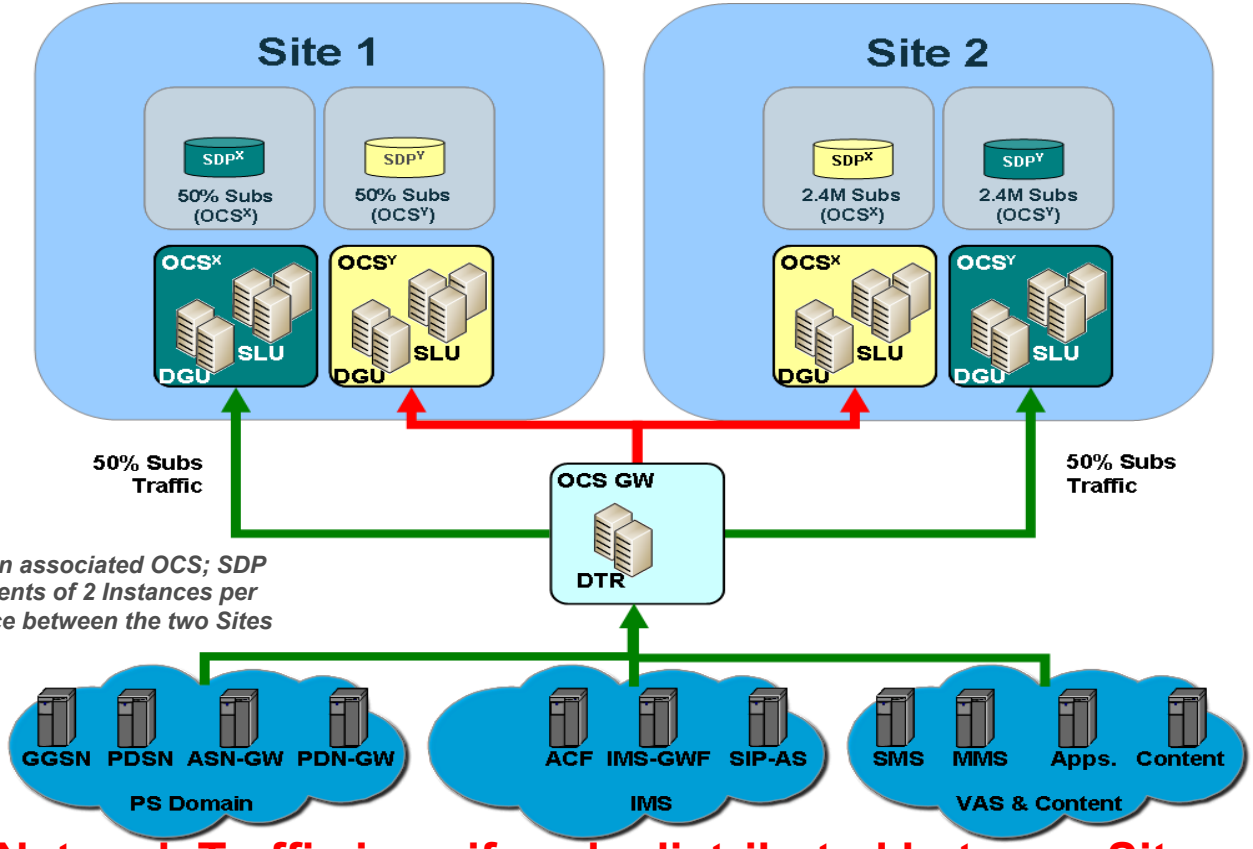


All Network Traffic is routed to the Active Site

COMVERSE

Geographically Redundant OCS Architecture

Under Normal Conditions:
100% Subscribers Availability with 100% Traffic Capacity

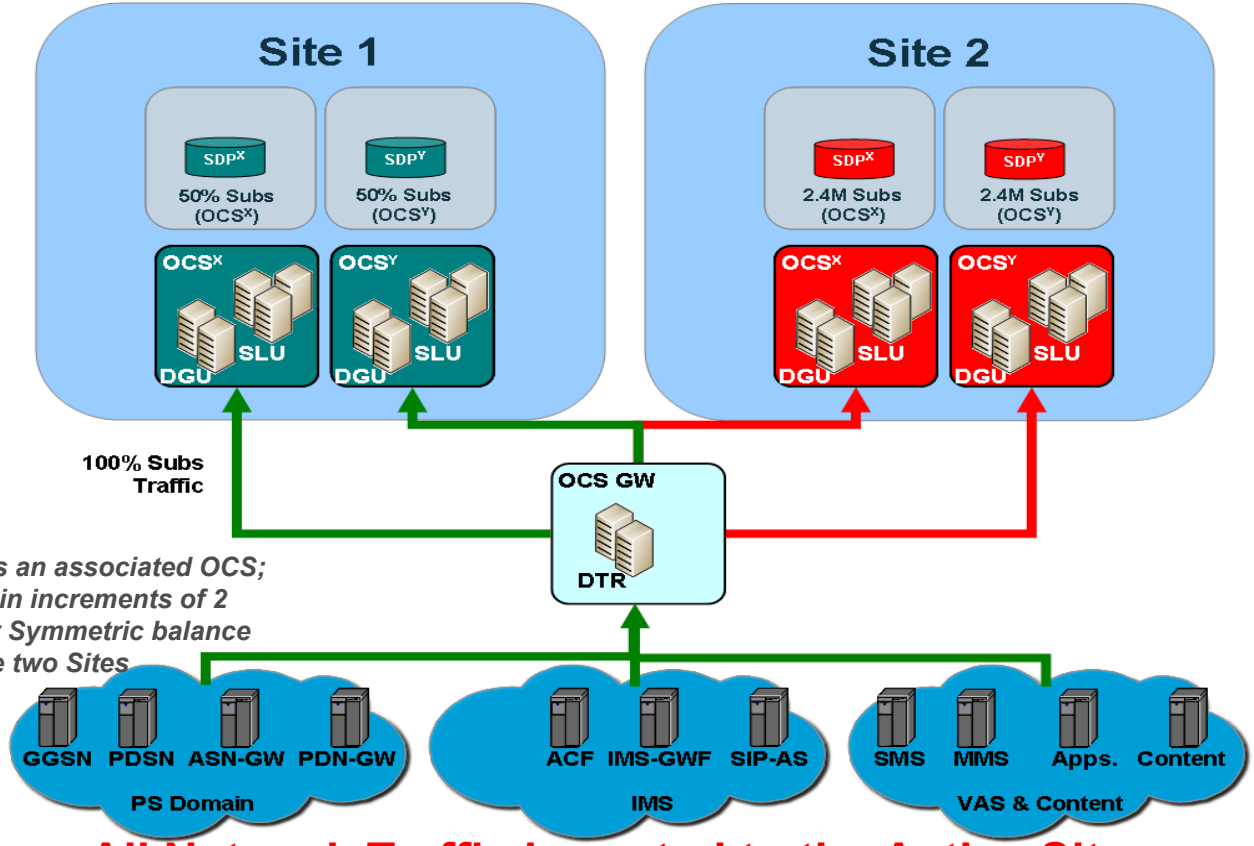


Each SDP Instance has an associated OCS; SDP may be added in increments of 2 Instances per Site for Symmetric balance between the two Sites

Network Traffic is uniformly distributed between Sites

Geographically Redundant OCS Architecture

In the event of a disaster:
100% Subscribers Availability with 100% Traffic Capacity



Each SDP Instance has an associated OCS; SDP may be added in increments of 2 Instances per Site for Symmetric balance between the two Sites

All Network Traffic is routed to the Active Site

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Thank You

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