CPFL Energy Group Applications Accelerated by Flash Technology

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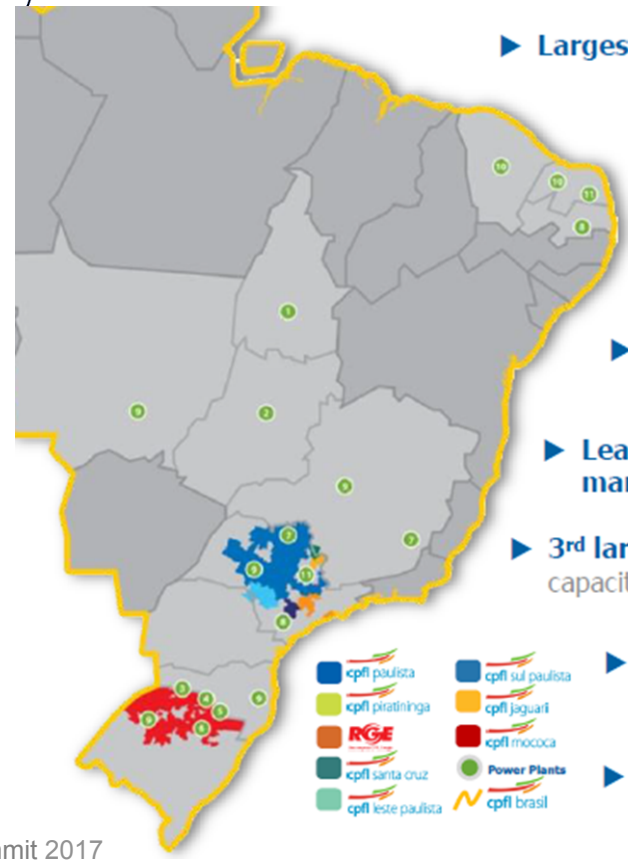
CPFL Overview – Highlights



- **Largest integrated private player** in the Brazilian electricity sector
  - Market Cap of **R$ 23.2 billion**[1], listed on **BM&FBOVESPA – Novo Mercado** and on **NYSE (ADR Level III)**
    - In LTM2Q16, EBITDA of **R$ 3.7 billion**[2] and Net Income of **R$ 1.1 billion**[2]
  - Presence concentrated in the **most developed regions** of Brazil
- **Leadership in distribution** through 8 subsidiaries and a **12.2% market share**
- **3rd largest private generator** with **3,189 MW**[3] of installed capacity, of which **94% from renewable source**
- **Leader in Renewable Energy** in Brazil with the largest capacity in operation
- One of the most **profitable operations of energy Trading** and a **world-class provider** of **Value-Added Services**

Technology on CPFL Business

▶ **The past:**

▶ **The future:**

Intelligent meter | Automatic failure detection | System intervention or self-healing | Real-time information for customers

Gains

- Reduced unnecessary travel;
- Shorter average service;
- Reduced SAIDI (optimization of possibilities of network maneuvering);
- Greater customer satisfaction (real-time information);
- Optimization of service to nearly 600,000 tickets every year.

Technology on CPFL Business

- **Vision of the Future of Distribution is directly associated with Smart Grids:**
  - The smart grid technology will provide increased network monitoring capabilities and greater quality and commercial opportunities
  - Smart Grids will boost the amount of information available, which will be used in innovative ways to optimize operations and services

Smart distribution was a key theme addressed by the Project **"Energy in the City of the Future"**

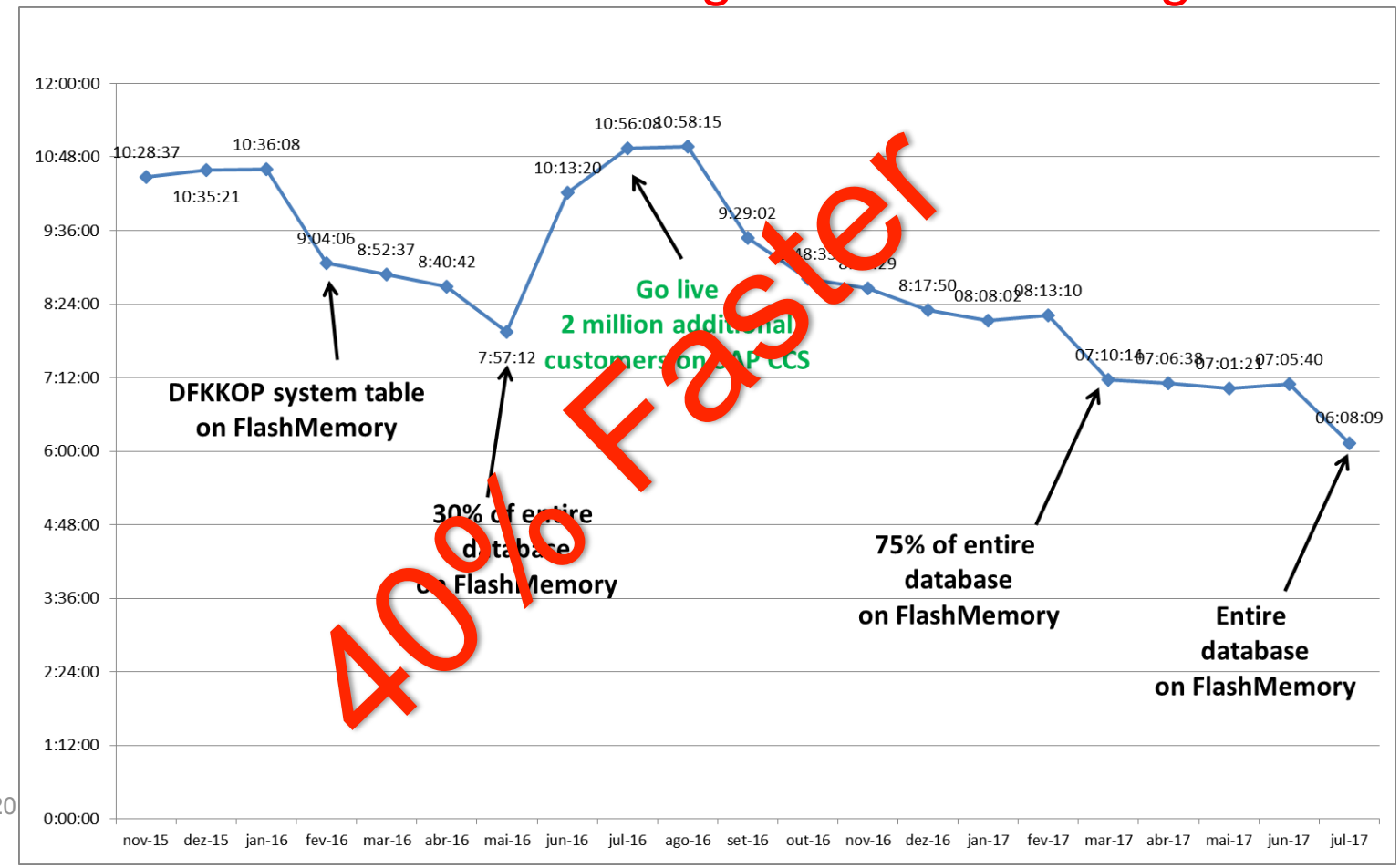
CPFL Project Targets

- Includes 2 million additional customers on SAP CCS billing system – CPFL M&A growth strategy
- Decrease overnight SAP billing batch process time
- Optimize Operation Center tasks
- Improve system accuracy and performance
- Reduce datacenter footprint and cooling/energy consumption

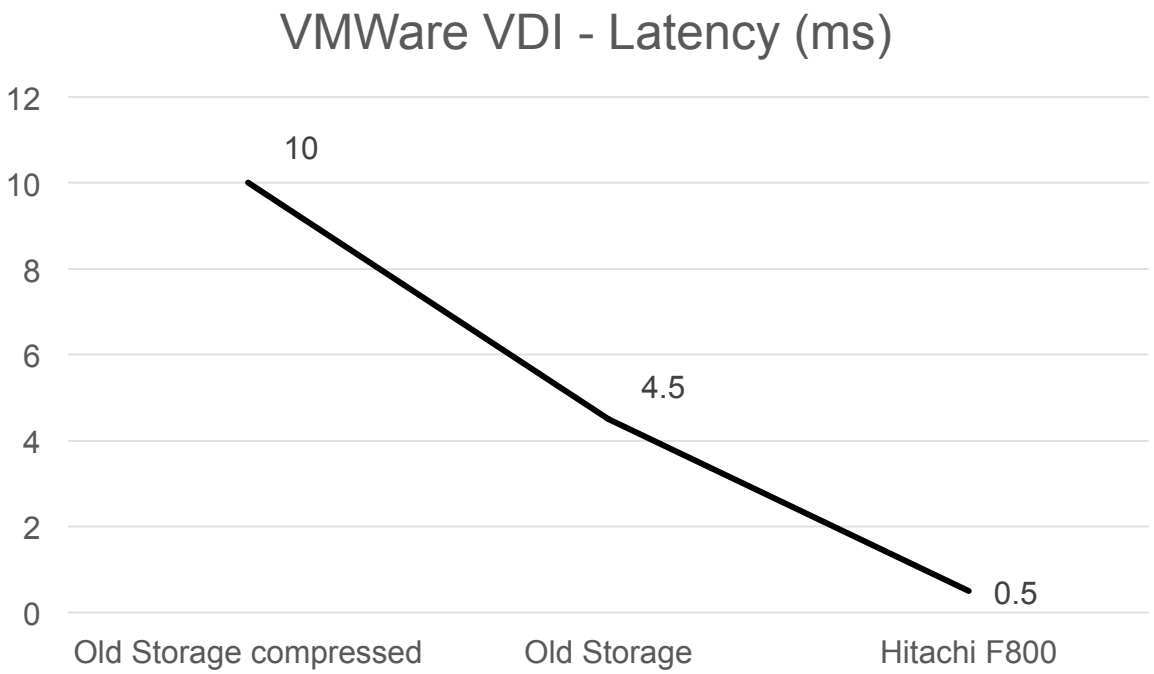
Results - SAP Billing - Process Average Time

Improve accuracy on fraud analysis

More data can be loaded and processed on BI solutions



Performance results – VMWare VDI



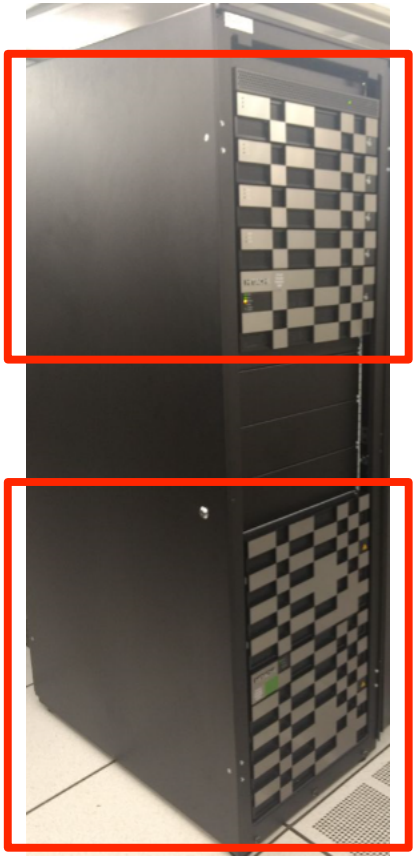
Accelerate Call Center Operations

Reduce Telecom costs on Call Center

Footprint Reduction

F800

G1500



- Half 42U Rack
- Double of storage area

Flash Memory SUMMIT

Hitachi Accelerated Flash 2.0

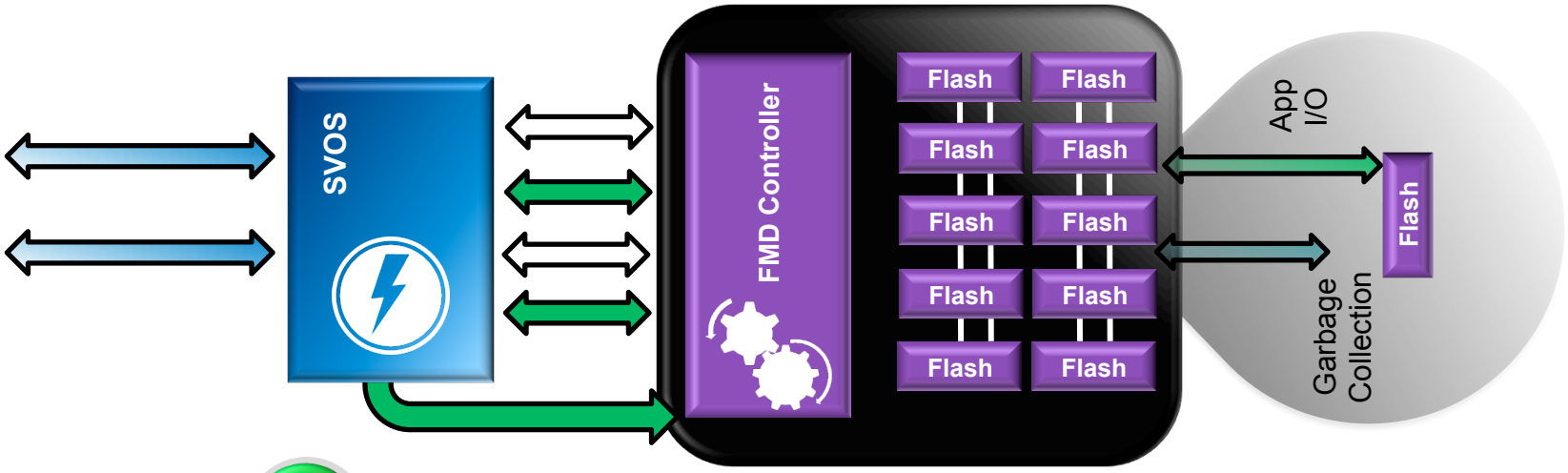
NEW

Improved flash-aware stack: SVOS uses flash-specific I/O processing to reduce overhead and lower latency

Adaptive data placement: Data placement rebalanced for consistent performance

NEW

Priority data handling: Allows bypass of system level activities for lower latency



NEW

New flash virtual memory scaling: SVOS leverages FMD memory for metadata offload for increased scale

Hitachi Accelerated Flash

TABLE 1. HITACHI ACCELERATED FLASH: SPECIFICATIONS

Models	FMD		FMD DC2			FMD HD	
Capacity TB (TiB)	1.7 (1.6)	3.5 (3.2)	1.7 (1.6)	3.5 (3.2)	7 (6.4)	7 (6.4)	14 (12.8)
Form Factor	High-density rack form factor						
Interface	SAS 6Gb/sec		SAS 12Gb/sec				
Data Protection	Full data path protection, end-to-end T10 Data Integrity Field support						
Device Tray	2U, 12 devices						
Thin Provisioning Integration	Yes						
Total Tray Capacity TB (TiB)	21.1 (19.2)	42.2 (38.4)	21.1 (19.2)	42.2 (38.4)	84.7 (76.8)	84.7 (76.8)	169.4 (153.6)
Flash Chip Technology	25nm 32GB MLC NAND	25nm 32GB MLC NAND	19nm 64GB MLC NAND	19nm 64GB MLC NAND	19nm 64GB MLC NAND	15nm 128GB MLC NAND	15nm 128GB MLC NAND
Number of Flash Chips (flash memory chips x bus)	16 x 4	32 x 4	8 x 4	16 x 4	32 x 4	16 x 4	32 x 4
Maximum Operating Temperature	35 degrees C		40 degrees C				
Power, Including Tray (Watts)	354	366	450				
Mean Time Between Failures (MTBF)	2 million hours						
Data Eradication Support	Supported						
Inline Compression Offload Support	N/A		Yes				
Workload Priority Access Support	N/A		Yes				

Single Device Sustained Performance							
Quality of Service at 1ms (60/40 read/write 8KB)	97.2%		99.6%				
Random Reads 8KB (kIOPS)	100	100	150	150	150	150	100
Random Writes 8KB (kIOPS)	70	70	80	80	80	80	80
Sequential Reads (GB/sec)	1.0	1.0	2.0	2.0	2.0	2.0	2.0
Sequential Writes (GB/sec)	0.8	0.8	1.0	1.0	1.0	1.0	1.0

Storage Configurations

- **1 VSP G600 Hybrid**
  - 33.4 TB – FMD 3.2TB with compression
  - 412 TB – SAS 10K 1.8TB
    - 2.6:1 Compression rate
    - 300.000 IOPS
- **1 VSP F800 ALL FLASH**
  - 112 TB – FMD 3.2TB with compression
    - 2.6:1 Compression rate
    - 800.000 IOPS
- **1 VSP G1500 ALL FLASH**
  - 246 TB – FMD 7TB with compression
    - 2.6:1 Compression rate
    - 1.200.000 IOPS

CPFL Energy Group Applications Accelerated by Flash Technology

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