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Smart Platform, aka TGDS in Telecom Italia
Value added services on mobile and fixed network using NonStop

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What is TGDS?

The **TGDS** is a platform based on **HP NonStop™ Server**, for the provision of value-added services on mobile and wireline networks, through the use of standard protocols: SIGTRAN/SS7, M3UA, DIAMETER, SIP and IP in general.

- It is developed and engineered in TIM, Milan, Italy
- It plays a set of application capabilities that support various services and business processes.
Where is TGDS?

It runs in:

- TIM (with >50 services),
- Tim Brasil (with 3 services),
- Telecom Argentina (with 5 services),
- KDDI Japan (with 3 services)
TGDS Blueprint

A solution that is scalable, reliable, multi-tenant, with TIM’s know-how

- it supports multiple applications / services on a single platform.
- It has a large suite of applications for mobility management developed in TIM
- It is flexible to incorporate new services quickly.
- It provides geographic redundancy to ensure maximum uptime.
- It supports multiple Telco domains (4G/LTE, 3G, 2G, SIP, ISUP)
- it is open to changes to adapt to new standards and protocols
- it allows you to optimize the TCO
TGDS is built on NonStop™

The TGDS is based on the reliability of hardware and software of HPE NonStop™ servers, that ensure fault tolerance and which allows to reach high levels of business continuity, proven over time and recognized as a prerequisite for the delivery of mission-critical services, with high added value.
HPE NonStop Servers

- Designed for the highest levels of reliability (fully fault tolerant)
- Data integrity
- Linear Massive Scalability - Hardware Virtualization
- Up to 16 CPUs / blades on a single server (node)
- Up to 255 nodes in an Expand network
- Up to 192,000 program processes for node.
- Up to 48.96 million program processes in an Expand network

HPE NonStop Environment

- Application virtualization on multiple CPUs and nodes
- Sharing, transparently, at the application level of: Processing Capacity; Storage; Network resources
TGDS – Fundamentals (2/5)

Operating system Guardian+OSS
- Parallel Processing
  - Shared-Nothing, Scalable
- Process-pair technology
- Data Integrity
- Built-in Security features + SecurSSO

Relational Database
- ENSCRIIBE: relational, partitionable, clustered.
- OC MBE: in Memory, relational, partitionable, Active-Active Sync.

SQL Database
- Open, modern, clustered
- Mixed workloads with no performance impact
- Virtualized data and query processing
- Automatic workload balancing

Application & Transaction Management
- Pathway AS: Fault tolerance, API, scaling, Web enabling capabilities for applications
- TMF: provides protection and concurrency control for both Enscribe and SQL database.
### HPE Intelligent Network Server

- Service Platform for the Core Network services
- Multiple concurrent call-processing applications
- In-flight transaction processing and message management
- Prioritized Message Queuing, protocol abstraction, and multi-threading
- Network Presence southbound, protocol neutrality northbound
- Parallel, fault-tolerant processing

### iTP Secure WebServer

- Support for services that use HTTPS transport protocol: Web application, Web-Services.
- Scalable, parallel, fault-tolerant processing
- High levels of security implemented.
- Message-switching facility between application and client: CGI, CGI-Pathway.
**TGDS – Foundamentals (4/5)**

### System Management

- HPE Standard management systems, integrated with Mission-Critical Converged Infrastructure from HP.
- Global Customer Support Center: WW support
- OSM Service Connection: integrated diagnosis and reporting of fault (HW, FW, env.)
- HPE Insight Remote Support: GCSC support automation

### Development Environment

- NonStop Integrated Development Environment (IDE) based on Eclipse™
- Development of NonStop applications on Microsoft® Windows workstations: edit, build, debug and deploy.
- PC-Based Cross Compilers for the build of NonStop software on PC.
- Support for various programming and scripting languages: C, C++, Java, Perl, etc.
- Visual Inspect: PC-based debugging tool (GUI).
TGDS – Fundamentals - recap (5/5)

“Applications and services developed by TIM”

TIM Applications
• Scalability and fault tolerance capabilities for applications developed by TIM

System Management
• Industry Standard Management tools
• Integration with Mission-Critical Converged Infrastructure

Development Environment
• Eclipse IDE, Cross Compiler on PC;
• C, C++, Java, Perl, ecc.

TGDS
Applications & Services made in TIM
Middleware INS, Pathway, iTP WS
Application Development Tools
Database and Transaction Management
System Management and Control
NonStop Operating System
NonStop Server

Database: Enscribe, MBE, SQL
• Clustered, Partitioned databases and in-memory.
• Active-Active in-memoryDB synchronization
• Protection on transactions

Operating System
• Scalability of parallel processes of shared-nothing type
• Dati Integrity
• Integrated Security

Hardware
• Tightly integrated hardware and software
• Highest levels of fault tolerance and massive scalability

“Integrated, virtualized stack with advantages in system operation, manageability, redundancy, data protection and … → TCO”
When used as a signaling nodes, on SIGTRAN and SS7 networks, the TGDS servers are assigned one or more Signalling Point Code (SPC) of TIM networks.

HPE Intelligent Network Server (INS) is used as *service execution environment* for services that require M3UA-SIGTRAN, SS7, Diameter and SIP connectivity.
HPE Intelligent Network Server (INS)
Software Service Platform for TGDS Core Network Services

Concurrent call-processing application support

- **Multiple concurrent call-processing applications**
- **In-flight transaction processing and message management**
- **Prioritized Message Queuing, protocol abstraction, and multi-threading**
- **Network Presence southbound, protocol neutrality northbound**
- **Parallel, fault-tolerant processing**
HPE Pathway + INS
Whole Software Architecture

Concurrent support of TIM service application + call-processing application
TGDS - Geographic redundancy

To ensure geographic redundancy and to interface with different access points to the signaling network, the TGDS (HPE NonStop™) servers are installed at two TIM sites:

- **Site «A»:** #5 NonStop™ Server in ServerNet Cluster (FC)
- **Site «B»:** #5 NonStop™ Server in ServerNet Cluster (FC)
TGDS in TIM network

**Milano**
- TGDS11
- TGDS13
- TGDS15
- TGDS17
- TGDS19

**Roma**
- TGDS16
- TGDS18
- TGDS19
- TGDS20

**Operations**
- OPB (MPLS Expand) + Large Account
- OP (Segnalazione su IP: Sigtran/Diameter/SIP)

**Development**
- Rete di Gruppo (Planet, DCNIP, VDCN, Dacon, DMZ)
TGDS in TIM network

Inter-site Expand™ and intra-site ServerNet™ communications

A communication architecture, inter-site and intra-site, based on Expand™ and ServerNet™, is an integral part of the TGDS platform. This architecture allows to make transparent and automatic the access operations toward shared remote resources: processes, disks, network interfaces.

The HPE NonStop™ servers themselves, although different from each other for HW and SW features and capabilities, thanks to this integration, constitute a "computational unicum" that places the TGDS among the most valuable TIM VAS platforms.
TGDS in TIM network

Expand™ Network Topology
Mobile Apps and Services Suite - Partnership

HPE portfolio expansion with an integrated suite of value added services

Areas:
- Roaming
- Messaging
- Device Detection
- Availability Services

Evolution of services on next generation networks
Service Areas (1 of 2)

**Messaging Services**
- Short Message Service Center
- SMS Transit GW for CSP
- World Wide Large Account
- SMS Notification for VM and IVR

**Roaming Services**
- Traffic Steering
- Welcome SMS
- Gateway Location Registry
- Roaming Unbundling

**Availability Services**
- LoSai di TIM
- ChiamaOra di TIM
- CCBS M/F & F/M
- Empty Call Capture

**MVNO Suite**
- Transit Gateway Full MVNO
- DUAL IMSI
- SMS-C
- Availability Services
- Roaming Services
Service Areas (2 of 2)

User & Device Detection Services
- MAP3
- EIR / IMEI-Manager
- DB Unico
- Event Triggered
- Integrated Device Management

Customer Management Services
- IMEI Promotions
- CRM Campaigns
- Customer Consents

VAS for Mobile Network
- 2in1
- HLR Set
- Pago io
- Generic Billing
- OPSC Gateway

Wireline Services
- RFGDS
- Stutter Tone for VM
Applications and Services
TGDS
It is the Short Message Service Center of TIM.

The service provides the functionality of "Transit SMS" for the Content Service Providers (CSPs) that send A2P SMS via MAP protocol. The main tasks that the service performs are:

- Checking that the SMSC of the CSP fails to make the MAP operations other than those provided for the application context of SMS delivery;
- Masking the GT of TI systems;
- Producing the documentation of the traffic (CDR).
**TGDS services in TIM network.**

**WWLA**

The founder of all SMS based services. It enables the exchange of SMS to: **World Wide Large Account** and **Fixed Network SMS** services. It embeds: a Virtual VLR and Virtual HLR towards the Core Network 3G/2G; a Message Handling System (MHS); various Gateway Protocol Interfaces toward IP data network.

**SMS Server (for IVR)**

It receives from the IVR, via IP, the SMS notification requests and submits them to the SMS-C (on TGDS) for delivery to the customers of TIM’s customers.

**Notify TGDS for I-BOX / UNITIM**

SMS notification service for Voice-mail.

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Franco Pampado, O.E.T. TSD
**TGDS services in TIM network.**

<table>
<thead>
<tr>
<th>Traffic Steering</th>
<th>It controls, in the 4G/3G/2G network, the signaling dialogue, between visited (VPLMN) and Home Network (HPLMN), driving the registration of a customer while roaming abroad on a partner operator networks.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome SMS</td>
<td>It allows sending, to a TIM customer who is abroad, a set of &quot;Welcome“ <strong>PUSH</strong> messages, while he/she is roaming on 4G/3G/2G.</td>
</tr>
<tr>
<td>Welcome Visitors</td>
<td>The service allows sending to foreign users roaming in TIM network a set of a &quot;Welcome“ <strong>PUSH</strong> messages.</td>
</tr>
<tr>
<td>Welcome On Board</td>
<td>It allows sending to passengers of cruise ships, as soon as they register in 3G/2G on MSC &quot;maritime&quot;, a set of customized “Welcome” <strong>PUSH</strong> messages.</td>
</tr>
</tbody>
</table>
TGDS services in TIM network.

GLR Hermes

Implementation of mobile network service Gateway Location Register (GLR) - 3GPP 29.120 and 23.119 standards compliant - allowing careful management of foreign users roaming on the Visited Network, reducing their movement to competitors networks, reducing signaling traffic between networks and optimizing the use of transmission resources.

Roaming
In order to comply to EU regulations, TIM started a project to integrate the Roaming Unbundling Solution in order to enable the support of **Local Break Out** and the **Alternative Roaming Providers** in EU market.

- **LBO service on TGDS** allows any EU operator to offer local data services to TIM subscribers; it performs appropriate actions on ARP user profile on visited SGSN in EU by providing a dedicated APN "EUInternet".

- With **Single IMSI running on TGDS**, TIM users will keep their current SIM and IMSI, but will be allowed to subscribe an ARP roaming service (voice, data and SMS) for the duration of their roaming in EU. In case of roaming outside EU or home network TIM users will remain on TIM service.
TGDS services in TIM network.

- **LoSai di TIM**
  - It notifies, via SMS, the TIM’s customer, when he returns available, the missed calls for the terminal switched-off, out of coverage, busy.

- **LoSai di TIM Fine Credito**
  - It notifies, via SMS, the TIM’s prepaid customer, the missed calls caused by end of credit.

- **ChiamaOra di TIM (con CCBS M-F & CCBS F-M)**
  - It notifies, via SMS, the TIM’s customer, the reachability of a previously unreachable number, or implements an automatic callback to user previously unreachable or busy (Call Completion on Busy Subscriber).

- **Empty Call Capture**
  - It notifies, via SMS, the TIM’s customer, the diverted calls toward the voice mail for which no message was left (empty message).
The service provides the functionality of "Transit SMS and USSD" with the Full MVNO's and produces the documentation of all transactions (CDR) related to this type of traffic that passes through the TIM network.

DUAL-IMSI allows customers of Full-MVNO to settle roaming in international networks, leveraging the TIM's roaming agreements and thus using 3G/2G roaming service (voice, data and SMS), with TIM's IMSI.

To this end, the Full-MVNO SIM are equipped with a double profile:
• A first profile, with numbers Full-MVNO, is used when the SIM is in Network TIM
• A second profile, with TIM numbers, is used when the SIM is roaming abroad.

MVNO FULL
- BT Italy
- DIGI Italy
- Noverca
- ENEL (Mundio)
- (Fastweb)
It sends SMS push notification to MVNO-ESP’s customers, for calls diverted to Voice-Mail, for which has not been left vocal message.
TGDS services in TIM network.

Welcome SMS MVNO
It allows sending, to MVNO ESP customers whom are abroad, a set of "Welcome" PUSH messages, while they are in roaming 4G/3G/2G.

SMS Server for IVR (MVNO)
It receives from the IVR, via IP, the SMS notification requests and submits them to the SMS-C (on TGDS) for delivery to the customers of MVNOs ESP.
TGDS services in TIM network.

**MAP3**
It stores and exposes toward external systems, through a query interface, the information on: MNP; MVNO; User Profiles; Macro-Localization; and also on the Terminal in Use - thanks to its i / f with “IMEI Manager” e “DB Unico” services.

**EIR-IMEI Manager**
**EIR (Equipment Identity Register)** manages the black list of the terminals to which it is not allowed to register on the network. **IMEI Manager** collects information from EIR (IMEI, IMSI, VLR, …) and makes them available to MAP3 and other VAS.

**DB Unico**
It is the service that manages the DB of the terminal mobile equipment: the brand and model are associated with TAC and various other attributes (e.g., GPRS, HSDPA, LTE, OPERATING SYSTEM, TYPE APPARATUS) that are provided by other sources of information (DBProdotti).

**IDM**
Integrated Device Management acts as a collector for the requests of device management operations (OTA type or OMA DM) coming from several external systems and applications.
It allows to trigger services based on a device registration on 4G/3G/2G. The input, from EIR/IMAI-Manager, is a registration event upon variation of the user/device pair, registration of a new user (IMSI), registration of a new device (IMEI), etc., is then dispatched to one or more services such as IDM, 3G provisioning, IMS provisioning, IT commercial offering system…

It is an application that is triggered upon APN's errors, that sends out, toward customer’s mobile equipment’s, the configuration SMS.

The service allows updating scripts present on the SIM type "Inter @ CTIM".
TGDS services in TIM network.

Promozione IMEI
- It manages commercial promotions based on the type of terminal.

Campagne CRM
- It manages commercial promotions based on the type of customer.

Consensi IVR
- It collects, via IVR, the "consent" of new customers to receive commercial information and ads.

Mobile Customer Management
TGDS services in TIM network.

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>2in1</td>
<td>It allows you to have two numbers associated with the same SIM. 2in1 on TGDS allows, through interaction with SMS or IVR, choosing from time to time the number of which to be reached and enables the termination of the voice call and SMS.</td>
</tr>
<tr>
<td>HLR SET - Set Call Divert</td>
<td>Exposes to the IVR, via protocol TLV / IP, the function of setting the call divert / call forward in HLR, for the causes busy, switched off or unreachable.</td>
</tr>
<tr>
<td>Pago io</td>
<td>It is an application for the &quot;Pay for me&quot; service, which collects the requests to accept calls, with charging to the recipient, for specific calling numbers. Then provides this information to the SDP of the Intelligent Network.</td>
</tr>
<tr>
<td>Radius Proxy</td>
<td>It receives and forwards RADIUS requests, to the HSS, enabling the early authentication procedure IMS.</td>
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</table>
A general purpose service that generates MT type CDR and L-L for other mobile network services.

A general purpose application that enables other mobile services to obtain credit information related to customer (prepaid, consumer).

The USSD (Unstructured Supplementary Service Data) Gateway acts as an interface between the 3G / 2G network and external applications, receiving and sending USSD messages.
### TGDS services in TIM network.

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<tbody>
<tr>
<td>RFGDS</td>
<td>It is the service that enables the exchange of <strong>SMS with the WireLine phones in Italy</strong>.</td>
</tr>
<tr>
<td></td>
<td>It acts as an “SMS gateway” between WireLine Network, some Web-based services and mail-services, and the 4G/3G/2G mobile networks.</td>
</tr>
<tr>
<td>Stutter Tone</td>
<td>It allows, to voice mail &quot;TIM Memotel&quot; service, for WireLine phones, to set the correct tone on the &quot;telephone exchange&quot;, in order to notify or not new voice-mail messages.</td>
</tr>
<tr>
<td></td>
<td>The service acts as a protocol gateway between IP data network and WireLine SIGTRAN Signaling Network.</td>
</tr>
</tbody>
</table>
SMS-C on TGDS (NonStop) – A success story of internalization

A Short Message Service Center (SMS-C) is a service to exchange Short Messages (SM) between mobile terminals and other systems (p. Ex. Computer).

SMS-C on TGDS was born in 2008, to the time of “second branding” (SIM branded MTV).

The system was then expanded to handle MVNOs (Coop, Tiscali, BT Italy).

In 2014 a project was launched to replace Acision (Xura) SMSC for TIM customers.

Since March 2016, all TIM SMS, pass by SMSC that runs on TGDS (NonStop) that is fully designed and managed by TIM.
SMS-C on TGDS (NonStop) – A success story of internalization
Grazie