CTI Billing Solutions Limited

Data limits and constraints

Analysis 7 1.10 – Core

Product	Analysis 7
Product version	1.10
Internal Version:	26.00
Doc Ref	MMA7DLC
Doc Version	2.00
Doc Status	Published
Circulation	Commercial in confidence
Doc Size	19 pages
Created on	Monday, 18 May 2015
Last modified on	Monday, 18 May 2015

CTI Billing Solutions Limited

CTI Billing Solutions Limited (CTI) ® *is part of* CTI Group (CTIG) ®.

A trusted partner to an enviable tier 1 and tier 2 client base – including many of the world's leading telecommunications providers and billing system developers – *CTIG* has a long history of providing *Call recording, eBilling* and *Analytics solutions*.

© 2013 CTI Billing Solutions Limited ®

Trademarks and intellectual property rights

The *Analysis7 (A7)* solution utilises *Liferay*®, which is the intellectual property of Liferay Inc.® and is licensed from them in accordance with the standard ***GNU LGPL 2.1 licence agreement.*** [1]

A7's web service utilises *Apache™ Tomcat™* and *httpd* ® licensed under the terms described in ***Apache Licence (version 2.0).*** [2]

Microsoft® and *Windows*® are the registered trademarks of *Microsoft Corporation*.

Oracle® is a registered trademark of *Oracle*®.

The *A7* database requires an *Oracle Database*® (a registered trademark of *Oracle*) database management system.

Where *Single sign-on option (SSO)* operation is not in use, the *Lightweight Directory Access Protocol (LDAP)* directory server of choice is *OpenDS*®, which is a registered trademark of *Oracle*.

CTI hereby acknowledge all trademarks, intellectual property rights and copyrights associated with the pre-requisite technology upon which it is built; a full list of which is distributed with the *A7* software.

The support and maintenance of any pre-requisite technology remains the responsibility of the customer and should be conducted in accordance with the relevant supplier's recommendations and industry best practise. Explicit support and guidance will be provided only where specific provision must be made for *A7* functionality; as specified in the *A7* licence agreement.

All other product or service names mentioned in this document are the trademark or service mark of their respective companies or organisations.

External references

CTI is not responsible for the availability of any third-party references (for example, URL) contained within this document; it neither endorses – nor is liable for – any content, advertising or other material available via the supplied references. *CTI* is not liable for any loss or damage incurred – or alleged to have been incurred – by recourse to these references.

[1] See text version of the license at http://www.gnu.org/licenses/lgpl-2.1.txt
[2] See a text version of the Apache licence at http://www.apache.org/licenses/LICENSE-2.0.txt

Our contact address:

CTI Billing Solutions Limited
Daisyfield Business Centre
Appleby Street
Blackburn
United Kingdom
BB1 3BL

Tel: +44 0 1254 291500
Fax: +44 0 1254 291504
Email: info@ctigroup.com

Feedback on this document

We are always looking for ways to improve the support we provide to our customers. Your feedback is invaluable in enabling us to do so.

Comment on this document via the following email address:

documentation@ctigroup.com

Document control

Version	Current Status	Publication Date	Author	Reason
2.00	Published	18 May 2015	Ian Bridge	Document uplifted for A7 v1.10
1.0	Published	4 July 2013	Ian Bridge	

Distribution list

Approval

Job title	Signature	Date
Trevor Davis Product Manager		

Reviewer's distribution list

Name	Position	Copy for
Rob Coates	Technical support	
Trevor Davis	Product manager	
Simon Riley	Senior developer	

Preface

Document definition

Objectives

To set out the data limits and constraints inherent within the Analysis7 system.

Audience

The information is technical in nature and would be useful for those responsible for:

- Technical support;
- Incident management;
- Application maintenance;
- Solution design and deployment;
- Performance monitoring and management.

Related documents

This document is part of the *Analysis7 documentation set*, which comprises:

Document title	Reference
Analysis 7 v1.10 Admin user guide	MMA7AUG
Analysis 7 v1.10 Branding Guidelines – CUSTOMER NAME	MMA7BGT
Analysis 7 v1.10 Data Limits Document	MMA7DLC
Analysis 7 v1.10 Data Description Document	MMA7DDD
Analysis 7 v1.10 Help desk guide	MMA7HDG
Analysis 7 v1.10 Installation Guide	MMA7INS
Analysis 7 v1.10 Operations guide	MMA7OPS
Analysis 7 v1.10 Pre-Installation Guide	MMA7PRE
Analysis 7 v1.10 Product Specification Core Back-office	MMA7BOPS
Analysis 7 v1.10 Product Specification Core Front-office	MMA7FOPS
Analysis 7 v1.10 Subscriber user guide	MMA7SUG

Document conventions

The following typographical conventions are used throughout this document.

Special notices

This symbol followed by green text enclosed in horizontal rules	Hints and tips on the process being described.
This symbol followed by red text enclosed in horizontal rules.	A warning about the process being described.
This symbol followed by blue text enclosed in	Important note or supplementary information about the process being described.

horizontal rules.

Contextual indicators

Serif italics	Used to indicate a *cross-reference* to another CTI Group document or to another section of part of this document
Strong serif italics	Used to cite a reference to an ***external document,*** that is a non-CTI Group document
Sans-serif italic emphasis	Used to indicate a reference to an *entity name* within the application being described (that is, the name of a *panel*, a *screen*, or a *data* field). For example: The *Scheduled reports* tab, the *Main Menu*
`<monospace in angled brackets>`	Used to indicate a `<token>`, for which you should substitute an actual value. For example `<profileName>` should be replaced by your profile name (`acme`) as allocated by CTI Group.
`Monospace text`	Used for the name of computer entities, such as a `filename` or a `/directory/path` name Also used to indicate `text` and `commands to be` entered. For example, 1. Input `My descriptive text` as **Description** 2. Input `sysadmin` as **Username**

`Monospace text on grey`	Used to show portions of code, scripts, or configuration files; and also multiple command line entries.
	For example:
	`cd /usr/`
	`mv myDirectory/ theirDirectory/`

Arial Narrow Italic - Grey	Used for table and figure caption text.
This symbol and bold text	This is used as a procedure header, which introduces a set of numbered instructions.
1. Numbered lists	Numbered lists are used exclusively for sequential instruction sets. They will usually be preceded by a procedure header.
Strong emphasis	Used to indicate one of the following on-screen elements, depending upon the context in which it appears: ▪ A **button** or **option** to be selected For example, click the button labelled Next to go to the next dialogue panel is simply: **Next** to continue ▪ Text to be typed For example: Type **This** ▪ A data field **Name** into which information is to be typed For example Input a **Description**
[Strong emphasis in square brackets]	Used to indicate a physical key (or button) to be pressed; for example the **[Enter]** key.

Contents

Table of chapters

No table of contents entries found.

Table of figures

Table of tables

Data limits and constraints

1 Introduction

This document details the limits of the *Analysis7* (A7) solution. It can therefore be used as a tool to determine the acceptability of customer data.

Three different types of limit are considered, each covered by a different section of this document:

- Fixed (or hard) limits.

  Typically those imposed by the database fields;
- Solution (or configuration) limits.

  Typically these limits are defined by the application;
- Topographic limits.

  Typically these are limits imposed by a combination of internal and external factors, as such they are difficult to quantify precisely, but they include for example, the precise mix of data types loaded into the system.

2 Fixed Limits

Fixed limits include the restrictions imposed by the database field types used to store the data.

- Data values

  The *Data interface specification* references the ***XSD standard*** but does not itself cover the limits of the *XSD* data-types defined within that standard.

- Field values
  - These are the values that are stored in the database (Oracle Database assumed);
  - The table (*Field limits* (on page 3)) lists the data items marked with 'x' for the DB type or limit/precision and scale set.

The application-imposed limit for some fields is lower than that allowed by their data type, these fields are denoted in the following tables by the symbols † and ‡:

† Integer -2,147,483,648 to +2,147,483,647;

‡ Long 9,223,372,036,854,775,808 to +9,223,372,036,854,775,807.

2.1 Standard data type limits

Table 1: Default data type limits (Oracle Database assumed)

Data type	Description	Range
`NVARCHAR2` (*size*)	Variable length national character set string having maximum length *size* bytes.	*Size* 1-4000 bytes.
`NUMBER` (*p*, *s*)	A number, having: (optionally): ▪ Precision *p*. Total number of digits; ▪ Scale *s*. The number of digits to the right of the decimal point).	▪ Positive numbers. Range 1 x 10^{-130} to 9.99...9 x 10^{125} with *p* up to 38 significant digits; ▪ Negative numbers Range: 1 x 10^{-130} to 9.99...99 x $10^{125}$with *p* up to 38 significant digits. ▪ Zero In the case where the data is provided to more decimal places than is defined by the scale (*s*), the number is rounded [3].
`DATE`	Valid date range.	Oracle handles Julian dates in the range January 1, 4712 *BCE* (*Before Common Era*) through December 31, 4712 *CE* (*Common Era*). CE dates are the default. Use `BC` in the format mask to force BCE dates.
`ROWID`	Hexadecimal string representing the unique address of a row in its table.	Maximum size is ten bytes.

[3] The Half-even rounding mode is used. In this mode the system rounds towards the nearest neighbour unless both neighbours are equidistant, in which case it rounds towards the even neighbour. This is the rounding mode that statistically minimises cumulative error when applied repeatedly over a sequence of calculations. This mode is sometimes known as Banker's rounding, it the main method used in the USA and is analogous to the rounding policy used for float and double arithmetic in Java.

Data type	Description	Range
UROWID	Hexadecimal string representing the logical address of a row of an index-organised table	The maximum size and default is 4000 bytes.
SUM	The SUM function takes as an argument any numeric data type and returns the same data type as the numeric data type of the argument.[4]	Fields used to hold the result of SUM calculations will have the same total limit as each of the individual fields being summed (the are the same data type). For example, if field <abc> had a maximum value of five, and was indicated as being a SUM field, then the maximum total value for the sum of all records would be five. These values are indicated in subsequent tables by an X in the SUM column in the table *Field limits (A7 Limits)* (on page 3).

2.2 Field limits

Table 2: Field size limits

Object	Data item	SUM	NVARCHAR 2	NUMBER (p, s)	DATE
Customer	CorpID		50		
	Name		60		
	Currency				
	SecondaryCurrency				
	ConsolidatedCorpID		50		
Bill	Date				X
	Name		50		
	Tax				
	Currency				
Invoice	Number		50		
	Date				X
	PreviousBalance			(19,4)	
	TotalPayment			(19,4)	
	TotalAdjustment			(19,4)	
	Tax			(19,4)	
	Email		50		
	Address1-8		60		
Handset	Number		50		
	Name		50		
Charge	DateTime				X
	DateFrom				X
	DateTo				X
	Value	X		(19,4)	

[4] Or any nonnumeric data type that can be implicitly converted to a numeric data type.

Object	Data item	SUM	NVARCHAR 2	NUMBER (p, s)	DATE
	Description		50		
	Qty	X		(19,4)	
	UnitPrice			(19,4)	
	OriginalValue	X		(19,4)	
	Data1		20		
	Data2		20		
Call	DateTime				x
	Number		50		
	AreaCode		10		
	Location		30		
	Duration †	X		(20,0)	
	Cost	X		(19,4)	
	OriginalCost	X		(19,4)	
	Events †	X		X	
	DataVolume ‡	X		(20,0)	

2.3 Summarised counters

Summarised counter values are not stored, but are calculated from many records.

Data	Number
Handset Count †	X
Volume CDR/Charge records †	X
Unique dialled numbers †	

3 Solution limits

Solution limits are restrictions imposed by design and coding; some of these may be varied by configuration settings.

These limits are typically imposed by constraints on performance or by usability issues within the user interface. Whilst they can be changed, to do so would incur performance and support costs.

The divergence from the core product would likely impact ongoing maintainability and could impact on your ability to upgrade to newer software versions,

3.1 Coding and configuration limited items

Table 3: Coding and/or configuration limited items

Data items	Notes and limits
Charge | Charge Sub code	A maximum of twelve *parent categories* are supported. The *parent categories* and their relationships to the *sub categories* are typically defined during the project.
Charge and Call | Service	There is no hard limit on the number of different *Service types*; but ten is the recommended maximum.. You may add new *Service* items dynamically without involvement by CTI. They will automatically appear in reports using the *Service* filter. It may be desirable for CTI to validate the *Service*; but they would then need to be involved when new *Service* items are used. This information is data driven and not translated; you will see the same meaning of *Service* displayed multiple times if supplied in multiple languages.
Call | TxType	There are ten supported *transmission* types.
Call | Bundle	There are four supported *bundle types.*
Call | Roamed	There are five supported *roam status types*.
Call | Category	There are 15 *parent categories* supported, these *parent categories* and the relationship to the *sub category* is typically defined during the project.
Call | CalDir	There are two supported *call direction types*.
Call | Internal	There are two supported internal types, represented as four possible values, but mapped to two.
Call | Usage	There are three supported *usage types,* represented as four possible values, but mapped to three.
Call | Peak	There are five supported *transmission types*, represented as four possible values but mapped to five.

3.2 Report configuration

Cost Range Report

The *cost range* categories can be defined as part of the project work. The first three categories are reserved for:

- Calls less than zero cost,
- Bundled calls with zero cost,
- Unbundled calls with zero cost.

An additional eight *cost range* categories are available. The first three of these categories can be removed from the reports as part of the project work.

You do not need to use or define all of the categories during the project work.

Duration Range Report

Duration range categories can be defined as part of the project work. Up to eight categories can be defined, the first of which is reserved for *non-duration based calls*. All the categories will be shown.

4 Topographic limits

Topographic limits include factors such as data loading. An imbalance in the data setup may impact performance even though the system allows such data to be loaded.

The following five factors determine the topography of the loaded data and have the capacity to affect performance significantly if their limits are exceeded:

- The number of groups;
- The number of handsets;
- The number of MNC/Corporate accounts making up an MNC;
- The number of bills loaded;
- The number of Multiplay Services.

However, it is not as simple as stating that the system can handle <n> number of groups, or <n> number of handsets. It is the combination of all the above factors that will have an effect on the performance as a whole.

For example:

Consider the case where we have, 500 MNC and, 25,000 total corporate accounts.

Whilst we may see adequate performance with 500 MNC if each comprised 50 Corporate Accounts, the system might not perform so well where a single MNC had 25,000 corporate accounts.

Likewise, the system might perform adequately where 100 MNC each had 1,000 corporate accounts; even though this means there are 100,000 corporate accounts in the system rather than the 25,000 in the previous scenario.

4.1 Initial starting values

Table 4: Factors affecting performance.

Dataset	Limits	Notes
MNC/ Corporate Accounts	550 MNC. [5]	Maximum of 50 corporate accounts per MNC.
Groups	1000 per MNC.	Based on limit of 1,000,000 handsets this equates to 100 handsets per group on average.
Handsets	1,000,000 total.	No more than 100,000 on one MNC. [6]
Bills	Twelve months summary.	Three months detail * 50 (accounts per MNC).
Multiplay	Five services in total. [7]	

[5] As defined in the Analysis7 hardware design document.
[6] As defined in the PRD.
[7] 10 for non-MNC solutions.

4.2 Changing the system data model

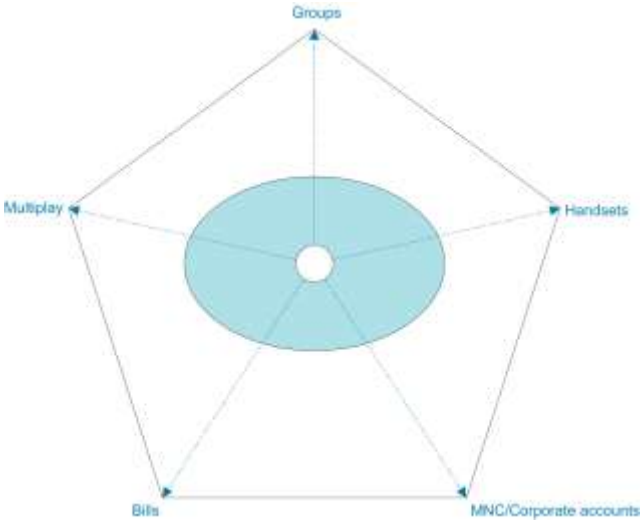
Considering the five factors as points of a polygon, there is a sweet spot at the intersection of all five points in the centre of the polygon, which corresponds to acceptable performance limits.

Balanced system

Using this concept of a performance sweet spot, the following diagrams show how varying the data model can affect performance.

The white circle in the blue area shows where the system will perform. In this diagram the data model is in perfect balance.

The overall area of the pentagon reflects the total amount of data loaded.



Increase number of groups

Notice in this diagram, the number of groups have been increased, but nothing else has changed (the area of the pentagon has been increased but in this case is acceptable – but obviously this has an impact). The values used, means the circle is still in the sweet spot and will perform

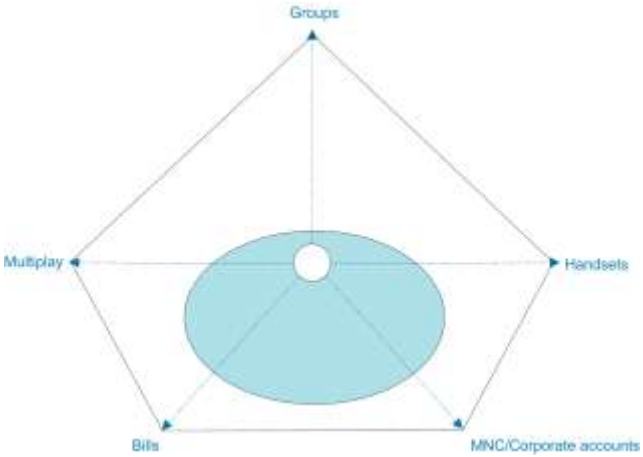


Figure 1: Sweet-spot: additional groups.

Increase number of handsets and groups

This time both groups and handsets have been increased. The values used means that the circle is no longer in the sweet spot and will not perform.

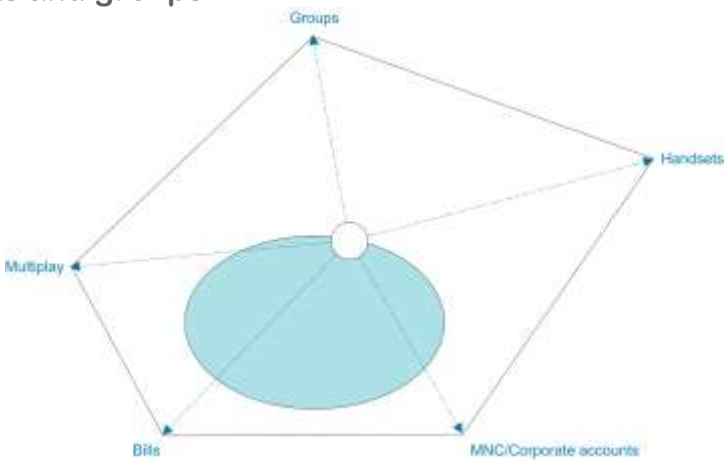


Figure 2: Sweet-spot: additional groups and handsets.

Finite limits

The overall area of the 'logical' pentagon cannot exceed that defined by the maximum values of each of the five factors.

So in this diagram - which appears to be in balance - performance would be unacceptable due to the sheer volume of data loaded; the factor values cannot just be expanded in proportion to each other.

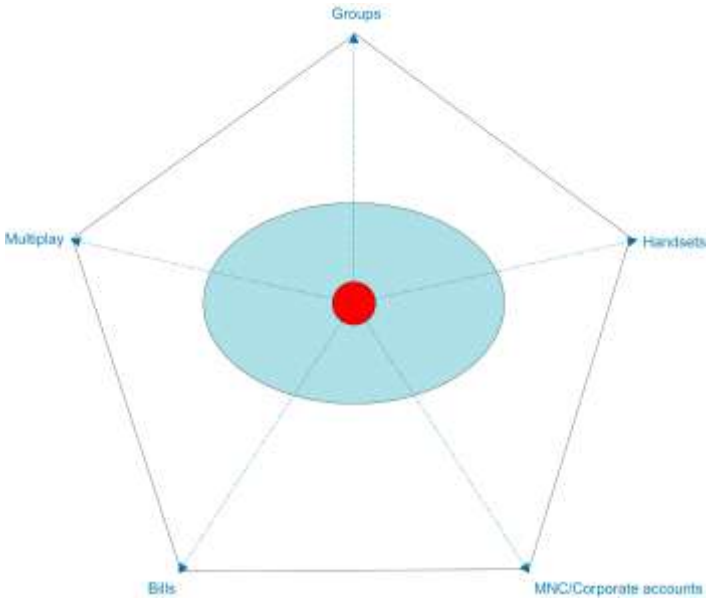


Figure 3: Sweet-spot: All factors increased.

4.3 Other limits

- The number of *CDR* directly impacts the performance of the report wizard and call download exports.

  CDR: 100,000,000.

- The number of users will affect login times and the creation of new users.

  Users: 250,000 total.

  A figure of 2,450 simultaneous users is in the ***A7 hardware design*** document.

[Inside back cover page]

Our contact address:

CTI Billing Solutions Limited

Daisyfield Business Centre
Appleby Street
Blackburn
United Kingdom
BB1 3BL

Tel: +44 0 1254 291500
Fax: +44 0 1254 291504

Email: info@ctigroup.com

Feedback on this document

We are always looking for ways to improve the support we provide to our customers. Your feedback is invaluable in enabling us to do so.

Comment on this document via the following email address:

documentation@ctigroup.com