

Balinese Script Reference Label Generation Rules for Second-Level Domain Names

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1. Overview

This document lays down the Balinese Script Label Generation Rule for the Second-Level Domain Names. Three main components of the Balinese Script LGR i.e., Code point repertoire, Variants and Whole Label Evaluation Rules have been stated in detail here.

The formal specification of the Balinese script LGR can be found in the accompanying XML document:

proposed-lgr-second-level-balinese-script-03jul24-en.html

2. Script for which the Second Level LGR is proposed.

ISO 15924 Code: Bali

ISO 15924 Key N°: 360

ISO 15924 English Name: Balinese

SNI: 9047:2021

Unicode: [Balinese – 1B00-1B7F](#)

Latin transliteration of native script name: Bali

Balinese Native name of the script: ꦧꦭ

3. Background

The development of the Internet has mainly taken place in one language namely English leading to language barriers for non-English speakers. The Internet was

mostly designed based on the simple English alphabet of the 26 Latin letters, the 10 “Arabic” digits (0-9), and the hyphen (plus, of course, the dots).

IETF has brought out the implementation standards for non-Latin and non-Roman characters, how the domain name is converted into puny code and how it resolves in the root zone files. The process of supporting multilingual script and other linguistic and cultural needs on the Internet is generally known as Internationalization. Internationalized Domain Names (IDNs) are domain names or web addresses represented in local language characters.

IDNs in Balinese Language/Script is one of the effective ways of further promoting the Internet among the Balinese Populace. For the proliferation and preservation of heritage, culture and content creation in multiple languages, it is essential to have the domain names in their scripts. The process of Internationalization involves the identification of the Character Set in the respective Script for each language, the identification of the Variant Set (they have the same sound, and they can be perceived as the same by the script users) and a Language-based implementation rule set. This is then followed by the process of normalization and coding for inclusion in the Domain Name System. An interface for Registrars for the issuance of Domain Names is then developed for the launch of Domain Name Registrations.

IDN is a societal issue as much as a technical challenge. Considering that a large number of users are not scholars of the language and hence can be easily cheated by homographs, spoofing, pharming as well as phishing will occur to a large extent in the Balinese language/script. This calls for great care and caution in supporting local languages and scripts in the domain names.

3.1 History of the Balinese Language and Script

Language is the most important part of human life because, with language, humans can communicate more perfectly. Language and script are media for expressing thoughts, feelings (emotional), spirituality, behaviour, ethnic origins, civilization, art and so on.

Bali is one of the thousands of islands in Indonesia. Bali and Indonesia are recognized internationally for their rich, diverse, and deep cultural heritage. The population of Bali in 2023 will be 4.3 million people, an average growth of 1.01% per year. In 2023, the number of elementary, middle school and high school/ vocational/ SLB students will reach 758,174 people with nearly 3200 schools available on this island. The Balinese language is a mandatory subject to be taught at any school in Bali as a local content curriculum. The Balinese language curriculum delivers both in Latin and in Balinese script. The students in Bali start practicing the Balinese language at school from the elementary to high school level. The number of students who use Balinese

names is 595,931 people (79%), and students 162,243 people use non-Balinese names (21%). The Bali Province Central Statistics Agency released the percentage of the Balinese population who use the Balinese language in their families and neighbours or relatives based on generations. 78.82% of the Post Gen Z generation or those who are currently nine years old use Balinese languages at home and 75.89% use Balinese languages among relatives or neighbors. Meanwhile, 88.07% of Generation Z or those currently aged 10-25 years use Balinese languages at home and 84.20% use regional languages among relatives or neighbours [103].

Education in the Balinese language existed during the time of the kingdoms; however, its nature was still traditional and in the family environment. The first school was founded in 1875 in Singaraja [101]. Moreover, the first textbook for school was published in 1913 with the title *Tjatoer Perenidanâ, Peratamaning tjakepan pâpeladjahan sang mâmanah maoeroek mâmaos aksarâ Belanda* [113].

In Indonesia, there are more than 600 ethnic groups and 719 mother-tongue languages spoken. The latest study by the Summer Institute of Linguistics (SIL) found that a significant 13 Indonesian mother-tongue languages have vanished and been forgotten as they are no longer used for daily communication [118]. In a mother-tongue language, the beliefs, philosophical values, rules, and traditions of a community can be understood and learned by the next generations and others [105]. When a language is forgotten, the loss is not only of the structural aspect of the language, which is the main focus of the linguistic domain but also the cultural and historical knowledge attached to the language.

The Balinese language is one of 719 living languages spoken in Indonesia and is mainly used on the islands of Bali and Lombok. People in Bali practice three different levels of Balinese language: high tongues (Basa Bali Alus), common tongues (Basa Bali Madya) and low tongues (Base Bali Sor). In the Balinese social system, there are four hierarchy levels that are highly related to how the Balinese language is used: common people (Sudra), traders or government officials (Waisya), the royal family (Kshatriya), and high priests (Brahmana). "The high and low tongues are distinct, unrelated languages with separate roots, different words, and extremely dissimilar characters" [104].

Up until today, many of the Balinese people have learned and transferred their cultural knowledge through socialization, where the Balinese let others experience the culture to understand it [110]. This can be seen in every traditional practice, such as the banjar adat and costume village (desa adat) ceremonies, which always involve a large number of people from the community [111].

The Balinese language, including its script and literary elements, is the intellectual property of the Balinese people which animates every aspect of life, both in cultural

and religious activities. Balinese language with dignity and grammar becomes a medium reliable for building the character and identity of Balinese people. Bali Governatorial Regulation Number 80 of 2018 mandates that on Thursday, full moon, no moon (*tilem*), and Bali Provincial Government Anniversary must use the Balinese language and Balinese dress. Also, this regulation concerns Balinese literature and Balinese Script. For instance, the use of Balinese script in institutional markers, roads, government official letterhead, and information media as seen in Figure 1, Figure 2, and Figure 3.



Figure 1. The use of Balinese script in institution marker/name



Figure 2. Balinese script utilized to write KFC at the American fast food in Bali



ပိတိကိန္နုဒု ဂျပာပိန္နုမိ တာပိ
PEMERINTAH PROVINSI BALI
 မိၵုၼ်းၼၢၵ်းၼၢၵ်းၼၢၵ်း
SEKRETARIAT DAERAH

တပူၼ်း တၢ်မုၼ်း တၢ်မုၼ်း တၢ်မုၼ်း - တၢ်မုၼ်း (ပိတိကိန္နုဒု) တၢ်မုၼ်း တၢ်မုၼ်း
 JALAN BASUKI RAHMAT DENPASAR - BALI (80235), TELEPON (0361) 224671
 Website : www.baliprov.go.id

Bali, 20 Mei 2021

Kepada

Yth. Kepala Perangkat Daerah di lingkungan
Pemerintah Provinsi Bali.

di -

Tempat

SURAT EDARAN
 NOMOR 13409 TAHUN 2021

TENTANG
 PENULISAN AKSARA BALI
 PADA KOP SURAT NASKAH DINAS
 DI LINGKUNGAN PEMERINTAH PROVINSI BALI

Menindaklanjuti Peraturan Gubernur Bali Nomor 80 Tahun 2018 tentang
 Perlindungan Dan Penggunaan Bahasa, Aksara, dan Sastra Bali serta
 Penyelenggaraan Bulan Bahasa Bali, maka perlu dilakukan penyesuaian pelaksanaan
 Tata Naskah Dinas di lingkungan Pemerintah Provinsi Bali, khususnya pada bagian
 Kop Surat yang wajib menggunakan tulisan Aksara Bali di atas tulisan Latin. (contoh
 terlampir).

Figure 3. Bali Province instructed to use Balinese script on every official letterhead

The Brāhmī script had developed approximately around 300 BC (Bühler, 1962). Brāhmī spread to northern and southern parts of India and it developed very widely geographically. There were two major waves in the spread of the Brāhmī script. The northern Brāhmī script later developed into various scripts, such as Siddhamatrka, Kuṭila, Proto-Bangla, Devanāgarī, Gujaratī, Śarada, Tibetan, Nepālākṣara/Rañjana, and so on. Meanwhile, the southern Brāhmī script itself developed into the Tamil, Kannada, Telugu, Malayalam, Sinhala, Khmer, Lao, Cham, Thai, Kawi, Batak, Sundanese, Javanese and other Indonesian archipelago scripts, including Bali.

Balinese is a Malayo-Polynesian language spoken by about 3.3 million people mainly in Bali in Indonesian. there are now more than 3 million speakers of Balinese. Around 80,000 live on the neighbouring island of Lombok while, largely due to transmigration, 40,000 speakers are found in southern Sumatra, and 60,000 in Sulawesi. According to the Bali Cultural Agency, a million or so people use Balinese in their everyday lives. However, in urban areas Balinese-speaking parents speak Indonesian to their children. The Balinese language is classified as an Austronesian language. The development of the Balinese language can be divided into three periods, namely *Bahasa Bali Kuna* (the ancient Balinese language), *Bahasa Bali Tengahan* (the middle age of the Balinese language) and *Bahasa Bali Baru* (the new Balinese language).

The Balinese language is written either in the Latin alphabet or the Balinese script. The Latin alphabet is generally used to write in the modern context, while the Balinese script is used for more traditional narratives and original manuscripts were written on palm leaves [114]. The usage of Balinese script in traditional manuscripts known as Lontar (palm leaf) is still prevalent today. Lontars are still copied, read, and appreciated in Bali. Many activities utilize the Balinese script, both cultural and religious, and are taught in schools as a mandatory subject.

The Balinese script, or *Aksara Bali*, is one out of 30 scripts available in Indonesia. This script is used for writing the native Balinese language known as *Basa Bali*. The Balinese script is derived from the Pallava and Devanagari scripts of India, and it has many similarities with modern scripts of South Asia and Southeast Asia. The Balinese script is mainly used for writing Kawi, or Old Javanese, which had a strong influence on the Balinese language [106][115].

The Balinese script is called Hanacaraka and it has been used since the 11th century AD [108]. The Balinese script can be used not only to write the Balinese language but also to write any language. This is because the Balinese script is based on the phonetic sounds of words, allowing it to represent the sounds of different languages effectively. The Balinese Script of Hanacaraka has common 18 consonant characters inherent to the syllables as shown in Figure 4.



Figure 4 The basic Balinese script - Hanacaraka

Vowel characters can be attached either after, before, above or below the main script or syllable [117] as illustrated in Figure 5. However, only one vowel is attached to the syllable ha. Furthermore, there are only two punctuations, that is, coma and period (Figure 6). Finally, the script is continuous and has no spaces between the words. The complex structures and rules for writing the script are known as *pasang aksara*. Due to the complex structure of the *pasang aksara*, other academics have researched the development of digital tools for auto-correction for Balinese script on Android operation systems [107].



Figure 5 Vowels positions (Pramartha & Dwidasmara, 2014)

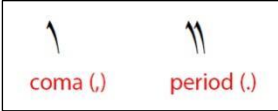


Figure 6 Balinese punctuation

Though everyday use of the script has largely been supplanted by the Latin alphabet, the Balinese script has a significant prevalence in many of the island's traditional ceremonies and is strongly associated with the Hindu religion. The script is mainly used today for copying lontar or palm-leaf manuscripts containing religious texts.

In total, there are over 185 unique characters or glyphs in the Balinese script. These are categorized into syllables, vowels, numbers, and punctuation [116]. The Balinese script is written from left to right without spaces between words or sentences, requiring readers to have a good understanding of Balinese vocabulary to comprehend the text.


3.2 Balinese Character Categorization

Balinese code points (Table 1) can be divided into four classifications: vowel, consonant, sign, and number.


- **Vowel (Aksara Suara)**, there are two classifications which are both accepted for IDNs.

- Dependent vowel. Dependent vowels can be utilized to write Balinese script in any language and need to be combined with consonants or independent vowels.

Example:

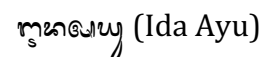
- *Melali*:  (vacation)

U+1B2B U+1B42 U+1B2E U+1B2E U+1B36

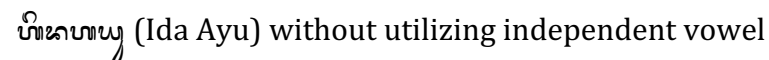
- *Perpustakaan*:  (library)

U+1B27 U+1B42 U+1B03 U+1B27 U+1B38 U+1B32 U+1B44 U+1B22
U+1B13 U+1B35 U+1B26 U+1B44

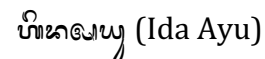
Independent vowel: The independent vowel is primarily used for personal names and languages other than Balinese, such as Indonesian and English. The independent vowel is utilized in combination with *aksara wreastra*. For example, the name 'Ida Ayu' can be written in Balinese script in four different variations:

-  (Ida Ayu)

U+1B07 U+1B24 U+1B05 U+1B2C U+1B38

-  (Ida Ayu) without utilizing independent vowel



U+1B33 U+1B36 U+1B24 U+1B33 U+1B2C U+1B38




-  (Ida Ayu)

U+1B33 U+1B36 U+1B24 U+1B05 U+1B2C U+1B38

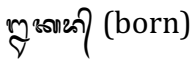

-  (Ida Ayu)




U+1B07 U+1B24 U+1B33 U+1B2C U+1B38

Note: According to the rules (*pasang pageh*) to write the Balinese script, there are certain spelling when using vowel  (1B0D) or vowel  (1B0B). However, for IDNs, as it is not required to restrict spelling and it may not carry meaning in the lexical sense, alternate spelling is also allowed. The examples below are similar cases of 'color' vs 'colour' in English.

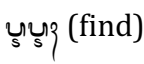

- Independent vowel  (1B0D), by spelling requirement, it will be used when consonant  (1B2E) combines with vowel sign pepet .

Examples

- *lekad*:  (born)
U+1B0D U+1B13 U+1B24 U+1B44 (correct spelling)
- 
U+1B2E U+1B42 U+1B13 U+1B24 U+1B44 (wrong spelling, but accepted for IDNs)

- Independent vowel  (1B0B) by spelling requirement, it will be used when consonant  (1B2D) combines with vowel sign pepet .

Example

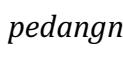
- *rereh*:  (find)
U+1B0B U+1B0B U+1B04 (correct spelling)
- 
U+1B2D U+1B42 U+1B2D U+1B42 U+1B04 (wrong spelling, but accepted for IDNs)

- **Consonant**, the writing system of Balinese script is the abugida system which is a segmental writing in Balinese characters in which consonant–vowel sequences are written as units. Balinese consonants have an inherent -a vowel sound. The Balinese script system consists of between 18 to 33 basic characters, depending on the language spoken. Each consonant, like in other Brahmi scripts, constitutes a syllable with an inherent vowel /a/ that could be modified by adding particular diacritics (Sound Character).
 - *Aksara Wreastra* is a Balinese character that is used to write the common Balinese language, which consists of Ha Na Ca Ra Ka Da Ta Sa Wa La Ma Ga Ba Nga Pa Ja Ya Nya
 - *Aksara Swalalita* is a Balinese character that is used to write words that derived from Sanskrit and Old Javanese, for example, in literature purposes like *Kekawin* and *Kidung*.
 - *Aksara Modre* is a Balinese character that is used to write mantras (*rerajahan*).

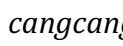
For the purpose of the Balinese script LGR for second-level domain names, only

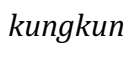
two types of consonant characters (Aksara Wreastra and Aksara Swalalita) are allowed as they are commonly used for everyday life in Bali.

- **Sign**, the signs (see Table 1) can be used for multiple purposes:
 - a. Two signs, 1B00 ulu ricem ീ and 1B01 ulu candra ീ, are excluded from the repertoire because they are only used to write a prayer or holy script such as *om* ീ.
 For example:
 - *Om sang naga raja* ീ
 - *Om swastiastu* ീ is a word to welcome and greet people in Bali.
 - b. The Behavior of Ra. 1B03 Balinese Sign Surang ീ: In traditional Balinese script rules, the sign surang ീ typically represents a final consonant -r. For example, in the word "*pasar*" ീ (market), is represented by the Unicode sequence U+1B27 U+1B32 U+1B03. However, in the context of Internet domain names, the character U+1B03 can be placed anywhere as long as it is used to represent 'r' and not 'ra'.
 - c. In traditional Balinese script rules, the behavior of nga ീ (U+1B17) changes to ng cecek ീ (U+1B02) instead of nga ീ (U+1B17) followed by adeg adeg ീ (U+1B44). However, in the context of Internet domain names, users can use either representation. Typically, users can differentiate between them by their distinct shapes.
 - When the end of the syllable of the basic word is *ng*. For example
 - *pucung*: ീ (bottle)
U+1B27 U+1B38 U+1B18 U+1B38 U+1B02
 - *barang*: ീ (goods)
U+1B29 U+1B2D U+1B02
 - When the end of the syllable of the basic word is *ng* gets a suffix, for instance *ne*. For example
 - *siungne*: ീ (fangs)
U+1B32 U+1B36 U+1B2C U+1B38 U+1B02 U+1B26 U+1B3E

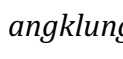
- *pedangne*:  (sword)
U+1B27 U+1B42 U+1B24 U+1B02 U+1B26 U+1B3E

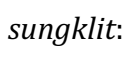
- When the end of the syllable of the basic word is *ng* gets a suffix, for instance *ne*. For example


- *cangcang*:  (anchor)
U+1B18 U+1B02 U+1B18 U+1B02

- *kungkung*:  (brackets)
U+1B13 U+1B38 U+1B02 U+1B13 U+1B38 U+1B02

- When we want to avoid using the below 2-base (see Figure 7). For example

- *angklung*:  (musical instrument made from two bamboo tubes)
U+1B33 U+1B02 U+1B13 U+1B44 U+1B2E U+1B38 U+1B02

- *sungklit*:  ((v) insert it at the waist)
U+1B32 U+1B38 U+1B02 U+1B13 U+1B44 U+1B2E U+1B36
U+1B22 U+1B44

d. The sign 1B34 *nukta*  is not included in the repertoire due to this sign seldom found being used today.

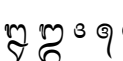

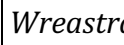

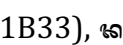



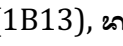



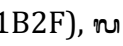



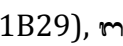



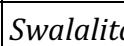

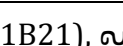
- **Numbers**,  (1 2 3 4 5 6 7 8 9 0 in Balinese script). See Table 1.

Table 1. Balinese Code Point Category

Category	Numbers	Sub-Category	Code Points
Consonants	18	<i>Wreastra</i>	 (1B33),  (1B26),  (1B18),  (1B2D),  (1B13),  (1B24),  (1B22),  (1B32),  (1B2F),  (1B2E),  (1B2B)  (1B15),  (1B29),  (1B17),  (1B27),  (1B1A),  (1B2C)  (1B1C)
	15	<i>Swalalita</i>	 (1B21),  (1B19),  (1B14),  (1B16),

			ညွ(1B1B), ဗွ(1B1D), ဗ(1B1E), ဖ(1B1F)*, မ(1B20), မ(1B23), မ(1B25), ဗ(1B28), မ(1B2A), ဖ(1B30), မ(1B31)
Vowel	14	Independent Vowel	မ(1B05), မ(1B06), ဗ(1B07), ဗ(1B08), ဗ(1B09), ဗ(1B0A), ဗ(1B0B), ဗ(1B0C), ဗ(1B0D), ဗ(1B0E), ဖ(1B0F), ဗ(1B10), ဗ(1B11), ဗ(1B12)
	15	Dependent Vowel Signs	ာ(1B35), ဝိ(1B36), ဝီ(1B37), ဝှ(1B38), ှ(1B39), ဝှ(1B3A), ဝှ(1B3B), ဝှ(1B3C), ဝှ(1B3D), ဝှ(1B3E), ဝှ(1B3F), ဝှ(1B40), ဝှ(1B41), ဝှ(1B42), ဝှ(1B43)
Signs	5	Various Signs	ဝိ(1B00)*, ဝိ(1B01)*, ဝဲ(1B03), ဝဲ(1B02), ှ(1B04)
	2	Signs	ဝိ(1B34)*, ဝှ(1B44)
Numbers	10	Numbers	ဝ(U+1B50)*, ဖ(U+1B51)*, ဗ(U+1B52)*, ဗ(U+1B53)*, ဖ(U+1B54)*, ဖ(U+1B55)*, ဖ(U+1B56)*, ဖ(U+1B57)*, ဖ(U+1B58)*, ဖ(U+1B59)*

*Code point marked will not be included in the code point repertoire (refer to section 5.1)

3.3 Features and Categories of Characters

The traditional Balinese script can be written with six components (see Figure 7 (a)), namely:

1. Baseline
2. Pre-base
3. Post-base
4. Above-base
5. Below 1-base
6. Below 2-base

However, based on the agreement among the Balinese people to make it easy to write and read the script, since 2002 and forward all the Balinese script should be written without the Below 2-base [102] [120]. Moreover, IDNs also use only five components (see Figure 7 (b)) due to the limitation of presenting the Internet domain name in the Internet browser URL address.

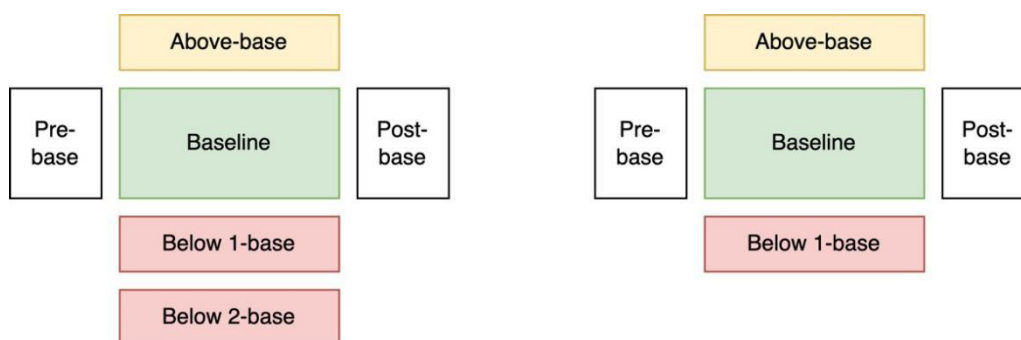


Figure 7. (a) Character position of the Balinese Script [106], (b) Propose Character Position of Balinese script for the Internet domain name

Example of using all positions in the Balinese script

1. *Om Swastiastu* = **ꦛꦺꦱ꧀ꦠꦶꦱꦠꦸ** (greeting in Balinese) (type a)
2. *Dumogi becik* = **ꦢꦸꦩꦲꦒꦶꦧꦺꦕꦶꦏ** (hoping everything ok) (type b)
3. *Matur Suksma* = **ꦩꦠꦸꦫꦸꦱꦏꦱꦩ** (thank you) (type b)

3.4 Fonts in Balinese Script

Several types of Balinese script fonts have been developed by the communities:

Developed by Aditya and David Kamholz ([source](#)):

1. [Vimala](#) = ᮘᮞ᮪
2. [Pustaka Bali](#) = ᮘᮞ᮪
3. [Kadiri](#) = ᮘᮞ᮪

Developed by Google:

[Noto Sans Balinese](#) = ᮘᮞ᮪

Developed by [I Wayan Sukanta](#) and David Kamholz:

[Natya](#) = ᮘᮞ᮪

[Developed by Balinese Language instructors:](#)

1. Bali Banat = ᮘᮞ᮪
2. Bali Raung = ᮘᮞ᮪
3. Mangu Sastra = ᮘᮞ᮪
4. Narada = ᮘᮞ᮪
5. Sapuh Laih = ᮘᮞ᮪
6. Sudamala = ᮘᮞ᮪
7. Tutud Bali = ᮘᮞ᮪
8. Urdhasastra = ᮘᮞ᮪
9. Singhambara = ᮘᮞ᮪

The recommended font for the Balinese script is Natya due to this font has been approved for use as the Indonesian national standard (SNI: 9047:202)

3.5 The Balinese Script Computer Keyboard (Tamiang)

This invention relates to a computer input device, namely a computer keyboard with a Balinese script layout interface for writing Balinese script on a computer application with Microsoft Windows and Mac operating systems without auto-correction if there is a mistake in writing the Balinese script. This keyboard invention is comprised of a frame, a circuit board mounted within the frame, and a plurality of keys placed on top of the circuit board. In addition, each variation key on the keyboard consists of two to four related letter variations.

Furthermore, the output of variation letters is generated from the button combinations of GANTASURI, GANTAPA, and GANTACEM to display the Balinese script that the user desires. This invention is in the form of a computer keyboard with a Balinese script layout that can be used to type 93 Balinese script characters (F) and the resulting document can be copied and shared without changing the appearance of the document that was previously created [112]. This keyboard was introduced to the public by the governor of Bali in 2021 and has been distributed to many schools around Bali. More information about this product can be found at <https://tamiang.oss.web.id>.

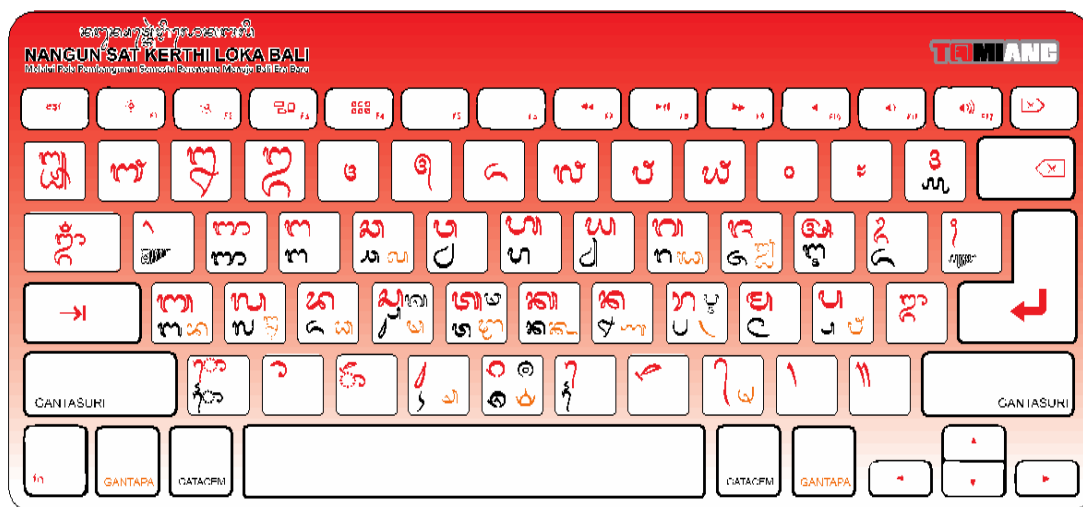
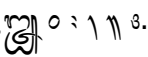




Figure 12. The Balinese script keyboard (Tamiang)

At the beginning of developing the Balinese keyboard, the glyphs for 1B11 ᮊ (Okara) and 1B53 ᮊ (digit 3) have the same shape/glyphs (user view) and the developer doesn't want to confuse users about the same shape with different purposes. However, the 1B11 ᮊ will be included in the next shipping of the keyboard.

¹ <https://bmc.baliprov.go.id/news/title/gubernur-bali-luncurkan-keyboard-aksara-bali>

approach to domain name management, facilitating easier access and reducing the risk of errors or misinterpretations .

If users wish to express numbers, they should use words for the representation. For instance, one (siki in Balinese)  (U+1B32 U+1B36 U+1B13 U+1B36) instead of 1  (U+1B51).

5.1 Included Code Points

Table 2. Included Code Points

No.	Code Point	Glyph	Name	Ref.
1	002D	-	HYPHEN-MINUS	
2	1B02		BALINESE SIGN CECEK	[112][116] [117] [119] [120]
3	1B03		BALINESE SIGN SURANG	[112][116] [117] [119] [120]
4	1B04		BALINESE SIGN BISAH	[112][116] [117] [119] [120]
5	1B05		BALINESE LETTER AKARA	[112][116] [117] [119] [120]
6	1B06		BALINESE LETTER AKARA TEDUNG	[112][116] [117] [119] [120]
7	1B07		BALINESE LETTER IKARA	[112][116] [117] [119] [120]
8	1B08		BALINESE LETTER IKARA TEDUNG	[112][116] [117] [119] [120]
9	1B09		BALINESE LETTER UKARA	[112][116] [117] [119] [120]
10	1B0A		BALINESE LETTER UKARA TEDUNG	[112][116] [117] [119] [120]
11	1B0B		BALINESE LETTER RA REPA	[112][116] [117] [119] [120]
12	1B0C		BALINESE LETTER RA REPA TEDUNG	[112][116] [117] [119] [120]
13	1B0D		BALINESE LETTER LA LENGA	[112][116] [117] [119] [120]
14	1B0E		BALINESE LETTER LA LENGA TEDUNG	[112][116] [117] [119] [120]

No.	Code Point	Glyph	Name	Ref.
15	1B0F	ꦏ	BALINESE LETTER EKARA	[112][116] [117] [119] [120]
16	1B10	ꦏꦶ	BALINESE LETTER AIKARA	[112][116] [117] [119] [120]
17	1B11	ꦏꦺ	BALINESE LETTER OKARA	[112][116] [117] [119] [120]
18	1B12	ꦏꦺꦝꦸꦁ	BALINESE LETTER OKARA TEDUNG	[112][116] [117] [119] [120]
19	1B13	ꦏꦏ	BALINESE LETTER KA	[112][116] [117] [119] [120]
20	1B14	ꦏꦩꦲꦥꦫꦤ	BALINESE LETTER KA MAHAPRANA	[112][116] [117] [119] [120]
21	1B15	ꦏꦒ	BALINESE LETTER GA	[112][116] [117] [119] [120]
22	1B16	ꦏꦒꦺꦴꦫ	BALINESE LETTER GA GORA	[112][116] [117] [119] [120]
23	1B17	ꦏꦁ	BALINESE LETTER NGA	[112][116] [117] [119] [120]
24	1B18	ꦏꦚ	BALINESE LETTER CA	[112][116] [117] [119] [120]
25	1B19	ꦏꦚꦭ	BALINESE LETTER CA LACA	[112][116] [117] [119] [120]
26	1B1A	ꦏꦗ	BALINESE LETTER JA	[112][116] [117] [119] [120]
27	1B1B	ꦏꦗꦗ	BALINESE LETTER JA JERA	[112][116] [117] [119] [120]
28	1B1C	ꦏꦚꦺ	BALINESE LETTER NYA	[112][116] [117] [119] [120]
29	1B1D	ꦏꦚꦭꦏꦶ	BALINESE LETTER TA LATIK	[112][116] [117] [119] [120]
30	1B1E	ꦏꦚꦩꦸꦫꦢ	BALINESE LETTER TA MURDA MAHAPRANA	[112][116] [117] [119] [120]
31	1B20	ꦏꦚꦩꦸꦫꦢ	BALINESE LETTER DA MURDA MAHAPRANA	[112][116] [117] [119] [120]
32	1B21	ꦏꦚꦫꦩꦧ	BALINESE LETTER NA RAMBAT	[112][116] [117] [119] [120]
33	1B22	ꦏꦚ	BALINESE LETTER TA	[112][116] [117] [119] [120]

No.	Code Point	Glyph	Name	Ref.
34	1B23	ᮓ	BALINESE LETTER TA TAWA	[112][116] [117] [119] [120]
35	1B24	ᮔ	BALINESE LETTER DA	[112][116] [117] [119] [120]
36	1B25	ᮕ	BALINESE LETTER DA MADU	[112][116] [117] [119] [120]
37	1B26	ᮖ	BALINESE LETTER NA	[112][116] [117] [119] [120]
38	1B27	ᮗ	BALINESE LETTER PA	[112][116] [117] [119] [120]
39	1B28	ᮘ	BALINESE LETTER PA KAPAL	[112][116] [117] [119] [120]
40	1B29	ᮙ	BALINESE LETTER BA	[112][116] [117] [119] [120]
41	1B2A	ᮚ	BALINESE LETTER BA KEMBANG	[112][116] [117] [119] [120]
42	1B2B	ᮛ	BALINESE LETTER MA	[112][116] [117] [119] [120]
43	1B2C	ᮜ	BALINESE LETTER YA	[112][116] [117] [119] [120]
44	1B2D	ᮝ	BALINESE LETTER RA	[112][116] [117] [119] [120]
45	1B2E	ᮞ	BALINESE LETTER LA	[112][116] [117] [119] [120]
46	1B2F	ᮟ	BALINESE LETTER WA	[112][116] [117] [119] [120]
47	1B30	ᮠ	BALINESE LETTER SA SAGA	[112][116] [117] [119] [120]
48	1B31	ᮡ	BALINESE LETTER SA SAPA	[112][116] [117] [119] [120]
49	1B32	ᮢ	BALINESE LETTER SA	[112][116] [117] [119] [120]
50	1B33	ᮣ	BALINESE LETTER HA	[112][116] [117] [119] [120]
51	1B35	ᮥ	BALINESE VOWEL SIGN TEDUNG	[112][116] [117] [119] [120]
52	1B36	ᮦ	BALINESE VOWEL SIGN ULU	[112][116] [117] [119] [120]

No.	Code Point	Glyph	Name	Ref.
53	1B37	ꦱꦺꦴꦱꦶꦫꦶ	BALINESE VOWEL SIGN ULU SARI	[112][116] [117] [119] [120]
54	1B38	ꦱꦺꦴꦱꦸ	BALINESE VOWEL SIGN SUKU	[112][116] [117] [119] [120]
55	1B39	ꦱꦺꦴꦱꦸꦲꦭꦸꦠ	BALINESE VOWEL SIGN SUKU ILUT	[112][116] [117] [119] [120]
56	1B3A	ꦱꦺꦴꦱꦸꦫꦺꦥꦩ	BALINESE VOWEL SIGN RA REPA	[112][116] [117] [119] [120]
57	1B3B	ꦱꦺꦴꦱꦸꦫꦺꦥꦩꦠꦺꦢꦸꦁ	BALINESE VOWEL SIGN RA REPA TEDUNG	[112][116] [117] [119] [120]
58	1B3C	ꦱꦺꦴꦱꦸꦭꦺꦁ	BALINESE VOWEL SIGN LA LENGA	[112][116] [117] [119] [120]
59	1B3D	ꦱꦺꦴꦱꦸꦭꦺꦁꦠꦺꦢꦸꦁ	BALINESE VOWEL SIGN LA LENGA TEDUNG	[112][116] [117] [119] [120]
60	1B3E	ꦱꦺꦴꦱꦸꦠꦺꦁ	BALINESE VOWEL SIGN TALING	[112][116] [117] [119] [120]
61	1B3F	ꦱꦺꦴꦱꦸꦠꦺꦁꦫꦺꦥꦩ	BALINESE VOWEL SIGN TALING REPA	[112][116] [117] [119] [120]
62	1B40	ꦱꦺꦴꦱꦸꦠꦺꦁꦠꦺꦢꦸꦁ	BALINESE VOWEL SIGN TALING TEDUNG	[112][116] [117] [119] [120]
63	1B41	ꦱꦺꦴꦱꦸꦠꦺꦁꦫꦺꦥꦩꦠꦺꦢꦸꦁ	BALINESE VOWEL SIGN TALING REPA TEDUNG	[112][116] [117] [119] [120]
64	1B42	ꦱꦺꦴꦱꦸꦠꦺꦥꦩ	BALINESE VOWEL SIGN PEPET	[112][116] [117] [119] [120]
65	1B43	ꦱꦺꦴꦱꦸꦠꦺꦥꦩꦠꦺꦢꦸꦁ	BALINESE VOWEL SIGN PEPET TEDUNG	[112][116] [117] [119] [120]
66	1B44	ꦱꦺꦴꦱꦸꦠꦺꦥꦩꦠꦺꦢꦸꦁ	BALINESE ADEG ADEG	[112][116] [117] [119] [120]

5.2 Excluded Code Points

These 14 Balinese scripts are excluded from current consideration to prioritize the implementation and stabilization of the most widely used characters in the Balinese script. This approach allows for a more manageable and focused initial deployment. However, their exclusion does not preclude their future inclusion. As the system matures and we gather more feedback from users and experts, we will evaluate the feasibility and necessity of incorporating these additional scripts in subsequent phases of development.

Table 3. Excluded Code Points

No.	Code Point	Glyph	Name	Category
1	1B1F	ꦩ	BALINESE LETTER DA MURDA ALPAPRANA	Consonant
2	1B00	ꦲ	BALINESE SIGN ULU RICEM	Dependent vowel
3	1B01	ꦲꦸ	BALINESE SIGN ULU CANDRA	Signs
4	1B34	ꦲꦸꦸ	BALINESE SIGN REREKAN	Signs
5	1B50	ꦲꦸꦸꦸ	BALINESE DIGIT ZERO	Digits
6	1B51	ꦲꦸꦸꦸꦸ	BALINESE DIGIT ONE	Digits
7	1B52	ꦲꦸꦸꦸꦸꦸ	BALINESE DIGIT TWO	Digits
8	1B53	ꦲꦸꦸꦸꦸꦸꦸ	BALINESE DIGIT THREE	Digits
9	1B54	ꦲꦸꦸꦸꦸꦸꦸꦸ	BALINESE DIGIT FOUR	Digits
10	1B55	ꦲꦸꦸꦸꦸꦸꦸꦸꦸ	BALINESE DIGIT FIVE	Digits
11	1B56	ꦲꦸꦸꦸꦸꦸꦸꦸꦸꦸ	BALINESE DIGIT SIX	Digits
12	1B57	ꦲꦸꦸꦸꦸꦸꦸꦸꦸꦸꦸ	BALINESE DIGIT SEVEN	Digits
13	1B58	ꦲꦸꦸꦸꦸꦸꦸꦸꦸꦸꦸꦸ	BALINESE DIGIT EIGHT	Digits
14	1B59	ꦲꦸꦸꦸꦸꦸꦸꦸꦸꦸꦸꦸꦸ	BALINESE DIGIT NINE	Digits

5.3 Normalization Forms

[Unicode Normalization Forms](#) are formally defined normalizations of Unicode strings which make it possible to determine whether any two Unicode strings are equivalent to each other. Depending on the particular Unicode Normalization Form, that equivalence can either be a canonical equivalence or a compatibility equivalence. IDNs require Normalization Form C (Canonical Composition). Therefore, the code points in NFC form are included in the repertoire, and the equivalent NFD form will be disallowed by the rules.

Table 4. Normalization Forms of Balinese Code Points

Source	NFC	NFD
1B06 ဇာ	1B06 ဇာ	1B05 ဇာ 1B35 ဝာ
1B08 ဇာ	1B08 ဇာ	1B07 ဇာ 1B35 ဝာ
1B0A ဇာ	1B0A ဇာ	1B09 ဇာ 1B35 ဝာ
1B0C ဇာ	1B0C ဇာ	1B0B ဇာ 1B35 ဝာ
1B0E ဇာ	1B0E ဇာ	1B0D ဇာ 1B35 ဝာ
1B12 ဇာ	1B12 ဇာ	1B11 ဇာ 1B35 ဝာ
1B3B ဇာ	1B3B ဇာ	1B3A ဇာ 1B35 ဝာ
1B3D ဇာ	1B3D ဇာ	1B3C ဇာ 1B35 ဝာ
1B40 ဇာ	1B40 ဇာ	1B3E ဇာ 1B35 ဝာ
1B41 ဇာ	1B41 ဇာ	1B3F ဇာ 1B35 ဝာ
1B43 ဇာ	1B43 ဇာ	1B42 ဇာ 1B35 ဝာ

6. Variants

6.1 In-Script Variants

The *Aksara Swalalita* are included as variants of *Aksara Wreastra* because they produce the same sound and are perceived as equivalent by script users, as explained in Section 3.2.

Table 5. In-Script Variants

Aksara Wreastra		Sound	Aksara Swalalita	
Code Point	Glyph		Code Point	Glyph
1B14	ဇာ	Ka	1B13	ဇာ

Aksara Wreastra		Sound	Aksara Swalalita	
Code Point	Glyph		Code Point	Glyph
1B16	ꦒ	Ga	1B15	ꦛ
1B19	ꦕ	Ca	1B18	ꦟ
1B1B	ꦗꦲ	Ja	1B1A	ꦛ
1B1D	ꦠꦫ	Ta	1B22	ꦠꦫ
1B1E	ꦠꦫ	Ta	1B22	ꦠꦫ
1B25	ꦢ	Da	1B24	ꦟ
1B20	ꦢ	Da	1B24	ꦟ
1B21	ꦤ	Na	1B26	ꦠꦫ
1B23	ꦠꦫ	Ta	1B22	ꦠꦫ
1B28	ꦥ	Pa	1B27	ꦥ
1B2A	ꦧ	Ba	1B29	ꦠꦫ
1B30	ꦱ	Sa	1B32	ꦱ
1B31	ꦱ	Sa	1B32	ꦱ


6.2 Cross-Script Variants




In addition to scrutinizing distinctions within the Balinese script variants, the analysis was extended to encompass a cross-script variant check, including comparisons with the Sinhala, Myanmar, and Javanese scripts.

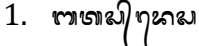


Based on the comprehensive investigation, to the best of our knowledge of the BRGP members, revealed no discernible similarities in shape that could compromise the security of Balinese IDNs from the user's perspective. This thorough examination provides reassurance regarding the visual distinctiveness and security integrity of Balinese IDNs.

There is no Cross-script variant required.

7. Whole Label Evaluation Rules

This section describes the Whole Label Evaluation (WLE) rules that are required by all languages using Balinese script. The Balinese script has its own rules called pairs of scripts and is divided into two, namely *pasang jajar* (without spacing between words) and *pasang palas* (with space between words). Pairing (*pasang*) is a style of writing a manuscript called *scripto continua* or writing continuously or without using spaces. *Pasang jajar* is usually used in writing manuscripts, such as lontar manuscripts, while *pasang palas* is the writing method that has undergone modernisation and supports use in the public domain. The use of *adeg-adeg* “” 1B44 in *pasang palas* is a separator symbol between syllables. For the second-level domain, users are permitted to use both rules (*pasang jajar* and *pasang palas*). The space in *pasang palas* will be utilized 1B44 as a separator (space) symbol.

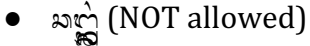
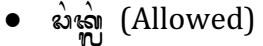
The utilization of the *adeg-adeg* “” (U+1B44) and hyphens “-” in the Balinese Script IDNs differs in their usage. The character “” (U+1B44) is frequently used to suppress the vowel when the preceding word ends with a consonant. Both “” (U+1B44) and hyphens (U+002D) can be simultaneously used in one or more words. For instance, the term “*Batas Desa*” (meaning “village's border”) could be represented as

1. 
U+1B29 U+1B22 U+1B32 U+1B44 U+200C U+1B24 U+1B3E U+1B32
2. 
U+1B29 U+1B22 U+1B32 U+1B44 U+1B24 U+1B3E U+1B32
3. 
U+1B29 U+1B22 U+1B32 U+1B44 U+002D U+1B24 U+1B3E U+1B32

7.1 Stacking Restriction

As discussed in Section 3.3, Balinese script domain names employing three stacks of consonants (including Below 2-Base) will NOT be permitted, allowing for a maximum of two consecutive consonants.

For example: *cangklang*

-  (NOT allowed)
U+1B18 U+1B17 U+1B44 U+1B13 U+1B44 U+1B2E U+1B02
-  (Allowed)
U+1B18 U+1B02 U+1B13 U+1B44 U+1B2E U+1B02

7.2 Typing Sequence Restriction

As previously mentioned, consonants, like in other Brahmi scripts, constitute a syllable with an inherent vowel /a/ that could be modified by adding particular diacritics (Sound Script).

- Dependent vowels, e.g., $\overset{\circ}{\underset{\circ}{\text{ᬓ}}}$ (i, u, e, o, ê) should be typed after a consonant or an independent vowel.

Example

○ *pesu*: $\text{ᬓ} + \overset{\circ}{\text{ᬓ}} + \text{ᬓ} + \overset{\circ}{\text{ᬓ}} = \text{ᬓᬓᬓᬓ}$

U+1B27 U+1B42 U+1B32 U+1B38

○ *inget*: $\text{ᬓ} + \overset{\circ}{\text{ᬓ}} + \text{ᬓ} + \overset{\circ}{\text{ᬓ}} + \text{ᬓ} + \overset{\circ}{\text{ᬓ}} = \text{ᬓᬓᬓᬓᬓᬓ}$

U+1B33 U+1B36 U+1B17 U+1B42 U+1B22 U+1B44

- Independent vowels, e.g., $\overset{\circ}{\text{ᬓ}}$ (a, i, u, e, o) can appear either before or after a consonant or another independent vowel.

Example.

○ *I gusti*: $\text{ᬓ} + \text{ᬓ} + \overset{\circ}{\text{ᬓ}} + \text{ᬓ} + \overset{\circ}{\text{ᬓ}} + \text{ᬓ} + \overset{\circ}{\text{ᬓ}} = \text{ᬓᬓᬓᬓᬓᬓᬓ}$

U+1B07 U+1B15 U+1B38 U+1B32 U+1B44 U+1B22 U+1B36

○ *aget*: $\text{ᬓ} + \text{ᬓ} + \overset{\circ}{\text{ᬓ}} + \text{ᬓ} + \overset{\circ}{\text{ᬓ}} = \text{ᬓᬓᬓᬓᬓ}$

U+1B33 U+1B15 U+1B42 U+1B22 U+1B44

7.3 Signs Restriction

Code Point	Can it follow the following character?						
	Consonant	Independent Vowel	Dependent Vowel	U+1B02	U+1B03	U+1B04	U+1B44
U+1B02	Yes	Yes	Yes	No	No	No	No
U+1B03	Yes	Yes	Yes	No	No	No	No
U+1B04	Yes	Yes	Yes	No	No	No	No
U+1B44	Yes	Yes	No	No	No	No	No

U+1B02 (ᬓᬓ) BALINESE SIGN CECEK Restriction

U+1B02 must follow a consonant or an independent vowel or a dependent vowel.

U+1B03 (ᬓᬓ) BALINESE SIGN SURANG Restriction

U+1B03 must follow a consonant or an independent vowel or a dependent vowel.

U+1B04 (ᮓ) BALINESE SIGN BISAH Restriction

U+1B04 must follow a consonant or an independent vowel or a dependent vowel.

U+1B44 (ᮓ) BALINESE ADEG ADEG Restriction

U+1B44 must follow a consonant or an independent vowel or a dependent vowel.

7.4 Dependent Vowel Restriction

In general, a dependent vowel must follow a consonant or an independent vowel.

Except for U+1B35 (ᮓ) BALINESE VOWEL SIGN TEDUNG,

as listed in Section 5.3, U+1B35 must follow a consonant to prevent the NFD form.

7.5 Summary of the WLE rules

In summary, the WLE Rules for Balinese script are:

1. “ᮓ” (U+1B44) is used at the end of a word, it cannot be at the beginning of a label, therefore:
 - a. it cannot be at the starting position of a label.
 - b. it cannot follow a hyphen.
 - c. it cannot follow a sign or itself (1B02, 1B03, 1B04, 1B44)
 - d. it cannot follow a dependent vowel.
 - e. it cannot follow two consecutive consonants and followed by another consonant to prevent below 2-Base stacking.
2. A dependent vowel, except **U+1B35**, must follow a consonant or an independent vowel.
3. U+1B35 must follow a consonant.
4. A sign (1B02, 1B03, 1B04) must follow a consonant or an independent vowel, or a dependent vowel.

8. Contributors

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