GS1

Pilot report

Bar Code EPC Interoperability Solution

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Document Description	This document is a report on a pilot project for a Bar Code EPC interoperability solution. It includes background information on the issue, a description and learning from the pilot and an outline of the next steps to be implemented.

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Disclaimer

1.   Executive Overview

The GS1 user community requires a tool enabling to use seamlessly any of the GS1 standard data carriers with any of the GS1 standard data sharing technologies. For example, translating automatically GS1 keys read from a bar code in standard RFID formats or using EPCIS on the basis of standard GS1 bar codes is a common requirement.

A project was initiated in 2012 to develop a universal and simple solution to this problem. The project undertook a pilot to prove the concept using real data from more than 10 GS1 member countries. The pilot successfully demonstrated that the conceptual solution that was elaborated works, responds to user needs and can be rolled out at minimal cost and in a short time frame.

The aim of this report is to explain the rationale for this project, to describe the pilot that has been completed and to suggest the next steps. It is submitted to the GS1 GO Leadership Team with the objective to get its support to move forward.

2.   Background

A fundamental principle of GS1 identification keys is that they don't carry any information. GS1 keys should always be processed in their entirety and used to access transactional and descriptive information available from electronic files. The design of the Electronic Product Code is based on three simple concepts: 1) the organisation responsible for the identifier (the "who"); 2) the class of entity (the "what") and the instance (the "which") identified by the serial number. The different standard elements of the EPC architecture framework make use of structured identification keys with the three components – who, what, which.

The GS1 Global Company Prefix that is included in all GS keys is a natural candidate for fulfilling the role of identifier of the organisation responsible for the identifier. The apparent contradiction between the non-significance principle and the EPC requirement for structured keys was analysed in detail by the GS1architecture group back in 2008. The problem statement was formulated as follows: **"The undivided nature of GS1 keys and the divided nature of EPC identifiers are an impediment to full interoperability of the two systems."** The conclusion of this research was that "significance" is useful and will become even more useful with the growing number of applications making use of GS1 identifiers in a networked environment.

A GSMP Mission Specific Working Group was established and it issued a comprehensive set of business requirements in July 2010. Some of these requirements called for guidelines addressing how end users and solution providers can design systems that confront the challenge of using various data carriers (bar codes and RFID) with various electronic communications technologies (EDI and EPCIS) to achieve the greatest degree of interoperability possible. A GS1 guideline named "RFID Bar Code Interoperability" was published in August 2012.

The user requirements for disposing of a tool enabling to translate seamlessly data captured from bar codes in structured EPC/FRID and EPCIS formats remained to be addressed. An essential characteristic of such a tool is to be able to determine automatically the length of a Global Company Prefix of any GS1 key.

The members of the group that developed the RFID Bar Code Interoperability guideline were invited to contribute to the development of such a tool on a voluntary basis. A core team comprising some 20 representatives of end users, solution providers and GS1 MOs and GO staff kicked off the project in August 2012.

3. Solution concept

GS1 Global Office will provide a consolidated table of ranges of Global Company Prefixes assigned globally. This table will be the core element that users and solution providers will integrate it into software components enabling to determine the GS1 company prefix length of any GS1 key. See Annex 1 for a snapshot of the table.

The solution concept is represented in the following figure:

1. **MOs send GCP range data to GO**

2. **GO collects GCP range data and compiles a single file**

3. **GCP Range file published to Internet**

4. **End users & solution providers download file**
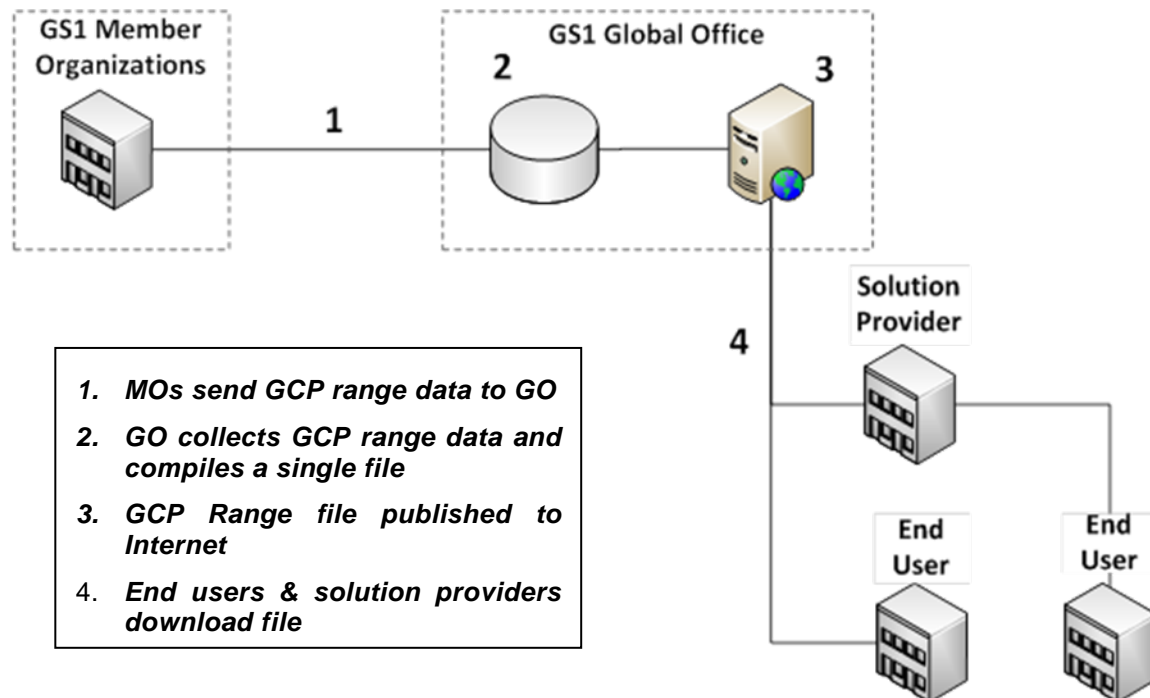
The following points are important to consider:

■ The table will not list actual GCPs but only prefix formats. For example, the table will contain an entry "03711 : 7", meaning that all GCPs starting with the digits 03711 are 7-digit long.

■ The solution does not aim at being used as an authentication tool. All it does is indicating the length of the company prefix present in a GS1 key.

■ The consolidated table of GCP range data is expected to be relatively stable. There will be no need to have online access to the table. The table will be available for download on request, e.g. on a weekly basis.

■ Ideally, the table should contain the data covering all ranges allocated by all MOs. In practice, it is likely that some data will not be available especially in the initial phase. The proposed solution does however not need 100% of data to be useable. If data is not available to for a particular key, an error message will be generated and other means should be used to determine the GCP length, see section 5.6 of the RFID Bar Code interoperability guideline available at http://www.gs1.org/docs/gsmp/RFID_Barcode_Interoperability_Guidelines.pdf.

■ It is expected that the solution will be widely adopted by Solution Providers and Users globally.

4.   Pilot

The Working Group met regularly between September and December 2012. It analysed different options for the file format that will be used for the GCP range consolidated data and agreed a simple XML format comprising the range indicator and the actual GCP length.

A GCP analyser tool was developed by a member of the group and made available to the working group. This tool uses as input the list of GCPs allocated by an MO and generates as output a file of ranges with the explicit indication of the GCP length.

Ten MOs agreed to participate in the pilot and made their GCP allocation rules available for that purpose. In addition, the GCP allocation rules used by GO to assign GCPs to companies located in countries where there is no local MO were included as well. The participating MOs were US, UK, Germany, France, The Netherlands, Serbia, Australia, Sweden, Japan and Germany.

The solution providers that participated actively in the working group and developed pilot software tools included Ken Traub consulting, Motorola Solutions and Intermec. In addition, GS1 Sweden developed a pilot software tool as well.

A set of 37 GS1 key values was defined for the purposes of the pilot, representing various test cases. The test data were used by the solution providers to test their software solutions. See annex 2 for a snapshot of the test data used for the pilot.

Test scenarios were established to simulate different configurations of the GCP range consolidated table. Solution Providers were invited to run the different test cases and to report the results.

Pilot lessons:

- Gathering MO data proved to be relatively easy. Several MOs, e.g. France, Japan, UK, Germany, have a very simple and stable set of rules. For other MOs, the GCP range data were generated by running the GCP analyser software tool against their database of allocated GCPs. This was also done for two MOs that have their GEPIR node hosted by GS1 GO.

- The GCP range consolidated table was stored in a fixed location on the Internet. It was accessed and downloaded by the participating Solution Providers without any difficulty.

- The pilot addressed the handling of exceptions such as one-off GS1 keys or numbering capacity allocated to external agencies to some extent.

- Clear specifications and user guides will be required in the roll-out phase. This should not pose any major difficulties as the key issues to be documented were identified during the pilot.

5.   From pilot to global roll-out

The next step will be to roll-out the project globally. This will be completed with the availability of a GCP range table comprising data from all MOs. For this to happen the following actions need to be implemented:

1. Develop a set of rules for all possible exceptions in a consistent way, e.g. one-off GS1 keys and numbering capacity allocated to external agencies.

2. Include handling of Restricted Circulation numbers and GTIN-8 in the global table.

3. Document the specification of the GCP range data to be provided by MOs.

4. Document the format of the global GCP range table.

5. Request each MO to provide the required data.

6. Validate the MOs input and consolidate in the global table.

7. Specify the detailed requirements of the required software tools needed to automate as much as possible the processes of gathering MOs data, creating the consolidated table and publishing it.

8. Develop the required software based on the detailed requirements. The software development will likely be done by GO using existing resources. The development effort is currently estimated at 6 weeks. A more precise figure will be available after the requirements analysis.

9. Develop a user manual explaining the concept, including specifications of the file formats.

10. Secure a permanent Internet address to store the GCP range consolidated table.

11. Secure a resource at GS1 GO, estimated at 0.10 FTE, to monitor the operation of the system when it will be launched globally.

12. Develop communication material to promote the deployment of the tool towards the solution provider and end user communities.

13. Develop measures for MO compliance level and bar code systems readiness to support EPC.

6. Challenges

- Privacy may be perceived as a possible issue given that MOs will be requested to share data based on assigned Global Company Prefixes. In reality, the project will not expose any assigned GCP or data related to assigned GCPs. It will only publish ranges of numbers without any indication that GCPs belonging to a given range have been assigned or not.

- Security may be seen as a possible issue as well. In early discussions of the working group, some MO representatives expressed reservations to participate because they feared to make it easier for malicious organisations to assign fake GCPs using actual ranges of numbers pre-allocated by their MO. It must be emphasised again that the project does not publish any genuinely assigned GCP. The project will not make it easier in any ways for criminals to assign fake numbers.

- The implementation of the tool may be perceived as an additional overhead to already complex systems implementing the GS1 system of standards. The tool made available by GS1 will effectively be a simple table in XML format with two entries: ranges of numbers and a GCP length associated to each range. The actual software tools will be developed by solution providers and users, consisting in a lookup of a local version of the GCP range consolidated table. The challenge will be the universal adoption of this facility. This will be addressed by a proper communication campaign and by the user realisation of the benefits of the tool.

- MO agreements to assign a portion of the GS1 Prefixes assigned to them to Third Parties could present an issue if the Third Party is unwilling or unable to meet the requirements and the MO has no contractual manner to compel them to do so.

7. Opportunities

- The business requirements identified during the development of the BRAD call for an offline solution enabling to determine the length of the Global Company Prefix from any GS1 key. The proposed solution fulfils these requirements.

- The growing adoption of EPCIS on the basis of event data captured from bar codes, especially in the health care sector, is a strong argument for making the Bar Code EPC interoperability solution available as soon as possible.

- The pilot has demonstrated that it is possible to roll out the proposed solution at minimal cost and efforts in a short time frame.

- The proposed solution will facilitate the adoption of GS1 standards using seamlessly any of the GS1 standard data carriers and GS1 standard data sharing technologies.

8. Timeline

1. January 2013: Secure GS1 LT support to roll out the piloted solution (done).

2. Jan-Apr 2013: Standards & guidelines
   a. Develop standard for file formats
   b. Develop tool for automated collection of data
   c. Develop tool for automated creation of consolidated table
   d. Develop guideline for Users
   e. Develop guideline for MOs

3. Jan-June 2013: Engage all MOs and collect their GCP ranges

4. July-Dec 2013: Roll-out the solution worldwide

Annex 1: Web address and snapshot of the global table
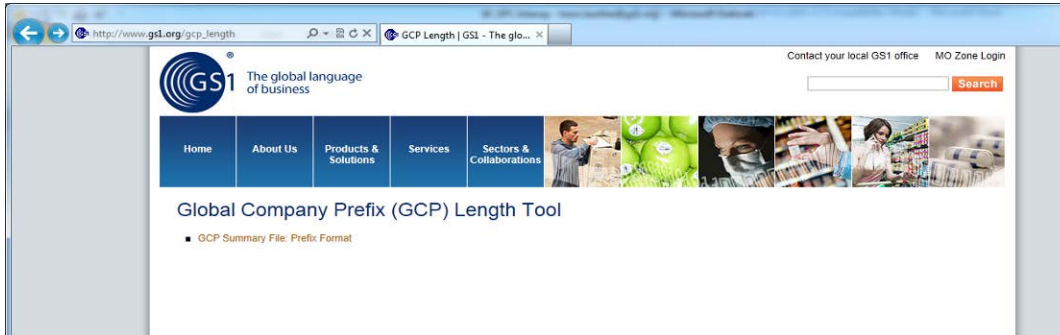

```
<?xml version="1.0"?>
- <GCPPrefixFormatList date="2012-12-21T12:21:12Z">
        <!-- EXCLUSIONS: The GCP Length Determination Tool project has defined a number of "Excluded" prefixes which are excluded from
        the GCP resolution process and have been assigned a nominal length of 0 in this file, as a sentinel value. There are currently SEVEN
        Excluded prefixes: 02, 04, 05, 2, 977, 98, 99 -->
        <!-- 5040 and 5041: Although earmarked by GS1 UK for the eventual allocation of 5-digit GCPs, prefixes 5040 and 5041 have each
        been assigned a nominal GCP length of 6 in this file, in order to comply with TDS-permitted GCP ranges of 6 to 12 digits. NB: As of
        December 2012 no 5-digit GCPs have actually been issued on the basis of prefixes 5040 and 5041. -->
        <entry gcpLength="7" prefix="00"/>
        <entry gcpLength="8" prefix="011"/>
        <entry gcpLength="10" prefix="018"/>
        <entry gcpLength="7" prefix="019"/>
        <entry gcpLength="0" prefix="02"/>
        <entry gcpLength="6" prefix="030"/>
        <entry gcpLength="7" prefix="031"/>
        <entry gcpLength="7" prefix="032"/>
        <entry gcpLength="7" prefix="0330"/>
        <entry gcpLength="7" prefix="0331"/>
        <entry gcpLength="6" prefix="03321"/>
        <entry gcpLength="7" prefix="03325"/>
        <entry gcpLength="7" prefix="03326"/>
        <entry gcpLength="7" prefix="03327"/>
        <entry gcpLength="7" prefix="03328"/>
        <entry gcpLength="7" prefix="0333"/>
        <entry gcpLength="7" prefix="0334"/>
        <entry gcpLength="7" prefix="0335"/>
        <entry gcpLength="7" prefix="0336"/>
        <entry gcpLength="7" prefix="0337"/>
        <entry gcpLength="7" prefix="0338"/>
        <entry gcpLength="7" prefix="0339"/>
        <entry gcpLength="7" prefix="034"/>
        <entry gcpLength="7" prefix="035"/>
        <entry gcpLength="7" prefix="036"/>
        <entry gcpLength="7" prefix="0370"/>
        <entry gcpLength="7" prefix="03711"/>
        <entry gcpLength="6" prefix="03714"/>
        <entry gcpLength="7" prefix="03716"/>
        <entry gcpLength="7" prefix="0372"/>
        <entry gcpLength="7" prefix="0373"/>
        <entry gcpLength="7" prefix="0375"/>
        <entry gcpLength="7" prefix="0376"/>
        <entry gcpLength="7" prefix="0378"/>
        <entry gcpLength="6" prefix="0380"/>
        <entry gcpLength="6" prefix="0381"/>
        <entry gcpLength="6" prefix="0382"/>
        <entry gcpLength="6" prefix="0383"/>
        <entry gcpLength="6" prefix="0384"/>
        <entry gcpLength="6" prefix="0385"/>
        <entry gcpLength="6" prefix="0386"/>
        <entry gcpLength="7" prefix="0387"/>
        <entry gcpLength="6" prefix="0388"/>
        <entry gcpLength="7" prefix="03891"/>
        <entry gcpLength="6" prefix="03897"/>
        <entry gcpLength="7" prefix="039"/>
        <entry gcpLength="0" prefix="04"/>
        <entry gcpLength="0" prefix="05"/>
        <entry gcpLength="7" prefix="06"/>
```

Annex 2: Test data used for the pilot

```xml
- <GS1TestKeyList date="2012-12-11T17:40:00Z">
  - <!--
      Legend of Expected Results
      I (Invalid) = the element string is incorrect, for example a GTIN with wrong check digit
      6-12 = the actual length of the company prefix for valid keys that can be resolved positively with the prefix table
      U (Undeterminable) = a valid element string format that is not resolved with the prefix table
      X (Excluded) = valid element string that is excluded from the GCP resolution process.
      There are currently SEVEN Excluded prefixes: 02, 04, 05, 2, 977, 98, 99
    -->
    <entry testKey="010018123467895821123455" expectedResult="10" resolvableURI="urn:epc:id:sgtin:0181234678.095.12345" />
    <entry testKey="010038502468542721123455" expectedResult="6" resolvableURI="urn:epc:id:sgtin:038502.0468542.12345" />
    <entry testKey="010360986423547321123455" expectedResult="6" resolvableURI="urn:epc:id:sgtin:360986.0423547.12345" />
    <entry testKey="010234567890123421123455" expectedResult="X" exceptionComment="GS1 prefix 23 excluded" />
    <entry testKey="012457584678915521123455" expectedResult="9" resolvableURI="urn:epc:id:sgtin:457584678.2915.12345" />
    <entry testKey="010505612345678621123455" expectedResult="8" resolvableURI="urn:epc:id:sgtin:50561234.05678.12345" />
    <entry testKey="010509712345678821123455" expectedResult="I" exceptionComment="Invalid check digit" />
    <entry testKey="011544556378437021123455" expectedResult="U" />
    <entry testKey="017860610420097421123455" expectedResult="10" resolvableURI="urn:epc:id:sgtin:8606104200.797.12345" />
    <entry testKey="018871862701123821123455" expectedResult="9" resolvableURI="urn:epc:id:sgtin:871862701.8123.12345" />
    <entry testKey="011888123456789221123455" expectedResult="U" />
    <entry testKey="010977123456789821123455" expectedResult="X" exceptionComment="GS1 prefix 977 excluded" />
    <entry testKey="80030037124587235712AB5F568" expectedResult="U" />
    <entry testKey="80030037454268415947B945" expectedResult="U" />
    <entry testKey="80030215878912456D14567PH" expectedResult="X" exceptionComment="GS1 prefix 21 excluded" />
    <entry testKey="8003050414571249684556897" expectedResult="6" resolvableURI="urn:epc:id:grai:504145.712496.456897" />
    <entry testKey="80030860610420304477POH756" expectedResult="11" resolvableURI="urn:epc:id:grai:86061042030.4.77POH756" />
    <entry testKey="80048735624781234558877744AA" expectedResult="U" />
    <entry testKey="80040045846923774xAZF569813" expectedResult="7"
      resolvableURI="urn:epc:id:giai:0045846.923774xAZF569813" />
    <entry testKey="800403788971463256486541850" expectedResult="7" resolvableURI="urn:epc:id:giai:0378897.146325648654185" />
    <entry testKey="8004372567214HIJ568" expectedResult="8" resolvableURI="urn:epc:id:giai:37256721.4HIJ568" />
    <entry testKey="80040412345987ABC" expectedResult="X" exceptionComment="GS1 prefix 04 excluded" />
    <entry testKey="25337795678412615945B1243" expectedResult="12" resolvableURI="urn:epc:id:gdti:377956784126..594531243" />
    <entry testKey="2534956789548263432522525" expectedResult="7" resolvableURI="urn:epc:id:gdti:4956789.54826.4322525" />
    <entry testKey="2535057584169543123B2345" expectedResult="U" />
    <entry testKey="25387172001234546789" expectedResult="7" resolvableURI="urn:epc:id:gdti:8717200.12345.6789" />
    <entry testKey="2539312345678914" expectedResult="I" exceptionComment="Missing serial number" />
    <entry testKey="00342687569423571671" expectedResult="9" resolvableURI="urn:epc:id:sscc:426875694.32357167" />
    <entry testKey="00502956254456546950" expectedResult="X" exceptionComment="GS1 prefix 02 excluded" />
    <entry testKey="00045989524635864664" expectedResult="U" />
    <entry testKey="00450551234123456754" expectedResult="8" resolvableURI="urn:epc:id:sscc:50551234.412345675" />
    <entry testKey="00336312312345678908" expectedResult="6" resolvableURI="urn:epc:id:sscc:363123.31234567890" />
    <entry testKey="80185072256477894145B0" expectedResult="U" />
    <entry testKey="80180371101123456B8904" expectedResult="7" resolvableURI="urn:epc:id:gsrn:0371101.1234567890" />
    <entry testKey="80188604568741232B9553" expectedResult="U" />
    <entry testKey="80184251234512345B7899" expectedResult="8" resolvableURI="urn:epc:id:gsrn:42512345.123456789" />
    <entry testKey="80188717206235649B78955" expectedResult="U" />
  </GS1TestKeyList>
```