3GPP SA WG1 Meeting #91-E
E-meeting, Aug 24-Sep. 2, 2020

S1-203181
Rev. of S1-20xxxx

"to present slides 7, 9, 10, 12"

New Study Proposal on 5G System Support for Service-Oriented Robots – Motivation Part II

- Use of DLT for robotics

Part I is in S1-203180

Disclaimer: This document and the related SID proposal are not intended to a general service aspect of DLT (Distributed Ledger Technology, or blockchain technology) but are intended to introduce possible introduction and use of interactions b/w a certain type of DLT (as a service layer) and 3GPP transport layer, specifically for **Service Robot use case scenarios**.

Source: Ki-Dong Lee (kidong.lee(at)lge.com), LG Electronics
Agenda item: 4
Document for: Discussion

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A list of Blockchain activities (in mobile industry)

- GSMA WP's:
  - #1 2017 "Blockchain for Development: Emerging Opportunities for Mobile, Identity and Aid"
  - #2 2018/07 "Blockchain – Operator Opportunities" (AT&T, DT, GSMA, KPN, Monty)
  - #3 2018/09 "Distributed Ledger Technology, Blockchains and Identity – A regulatory overview" (focusing on "digital identity")
- 3GPP:
  - SA1: attempted to spin DLT (traceability aspect) off from SLIM
  - SA6: S6-200699

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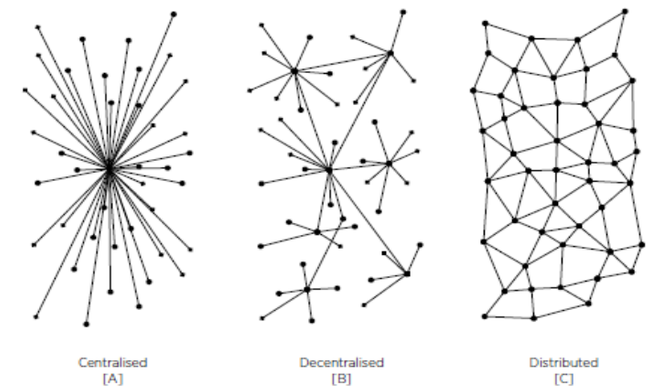
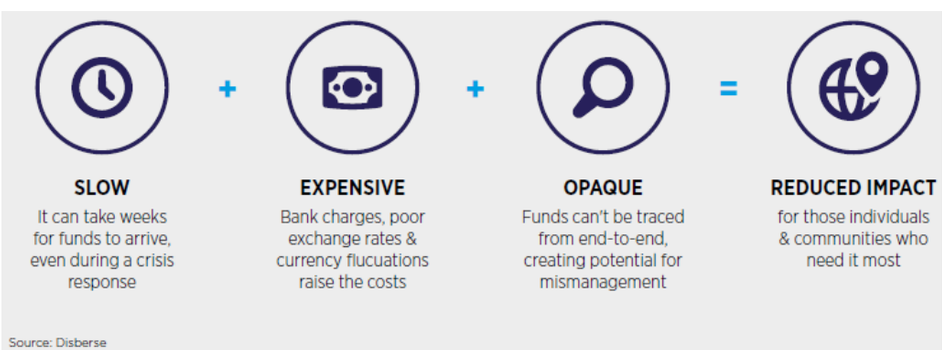
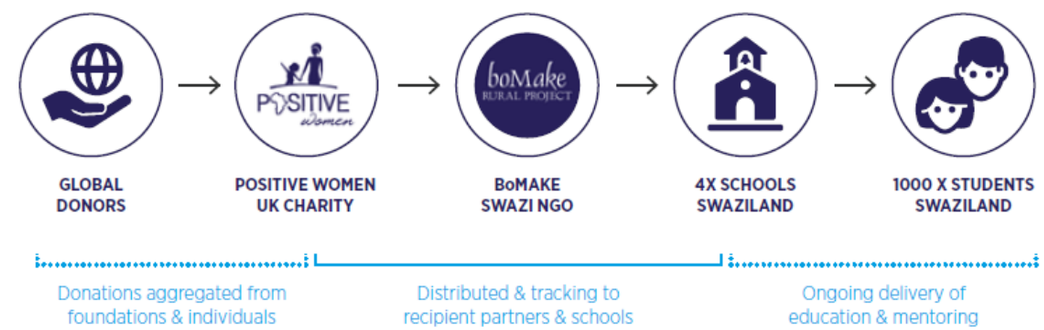
A quick summary #1

- GSMA WP #1 2017: “Blockchain for Development: Emerging Opportunities for Mobile, Identity and Aid”
  - Use Case 1: Blockchain and Self-Sovereign Digital Identity
  - Use Case 2: Blockchain and International Aid Delivery
  - Use Case 3: Blockchain and Humanitarian Cash Payments







Source: Disberse

Allen, C. (2016). *‘The Path to Self-Sovereign Identity’*. Available at: http://www.lifewithalacrity.com/2016/04/the-path-to-self-soverereign-identity.html [Accessed 15 Nov. 2017].

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A quick summary #2

- GSMA WP #2 Jul. 2018: “Blockchain – Operator Opportunities” (AT&T, DT, GSMA, KPN, Monty)
  - Objectives: to improve biz process, to reduce costs, and to enable new biz opportun.
  - Opportunities arising in a sharing economy: prosumer (consumer + provider)

  - Supply Chain Management
  - Self-Sovereign Identity: bridge the gap b/w real and digital identities
  - Content distribution: remove intermediaries from the process (directly from content provider straight to CSP customer devices)
  - Crypto-wallet: who is going to be the bank? Still the conventional bank or MNO (CSP)?
  - Smart city
  - ads

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A quick summary #3

- GSMA WP #3 Sep. 2018: "Distributed Ledger Technology, Blockchains and Identity – A regulatory overview" (focusing on "digital identity")
  -

The European Union Blockchain Observatory and Forum

In the EU, the European Parliament's initial report in 2016 concluded that blockchain technology could deliver a "revolution in the security and transparency that is needed to enable e-voting." Interestingly, the European Commission has stated that the almost limitless list of potential use cases of DLT makes it both very promising and challenging, and has expressed its support for blockchains and DLT.

In February 2018, the Commission launched the EU Blockchain Observatory and Forum that aims to highlight key developments of blockchain technology, promote European actors and reinforce European engagement with multiple stakeholders involved in blockchain activities.

In April 2018, 22 countries from the EU signed a Declaration on the establishment of a European Blockchain Partnership as a vehicle for cooperation amongst Member States to exchange experience and expertise in technical and regulatory fields and prepare for the launch of EU-wide blockchain applications across the Digital Single Market for the benefit of the public and private sectors.

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Other common views on new biz opportunities

1. Record of transaction (e.g., who did what, when, where, and what's the result)
2. Banking: Internet of Money (cryptocurrency)
   - Secure money storage
   - Avoid intermediaries → simpler, faster, cheaper
3. Financial assets:
   - Stocks, real estates → much more efficiently transacted than using conventional system
4. SCM: Monitor, track, verify (no fraud)
5. Luxury goods (e.g., diamond): transparency, security and trust
6. IPR: e.g., using timestamp (authenticity)
7. Digital identity: Know Your Customer (KYC), anti-money laundry

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Observation

- **Generic:** What if two Robots (miners) generate blocks at similar times?
  - Only one would and could be accommodated as the subsequent block of the latest block (last block) attached to the chain in consensus
  - *In multi-robot service operations: What if two Service Robots generate blocks (containing info on their work status, work completed, etc.) from the "same" latest block of the chain?*
  - *In cryptocurrency operations: can one trust an orphan block (not part of the chain) to make transaction for another/new item/service? (Yes or No)*
- Orphan block
  - The only one block that is accepted by the chain is to be added to the chain whereas the others, if any, are NOT ultimately accepted by the chain although each of them is valid transaction.
  - "valid": the previous block is correct and the transaction is correct/true

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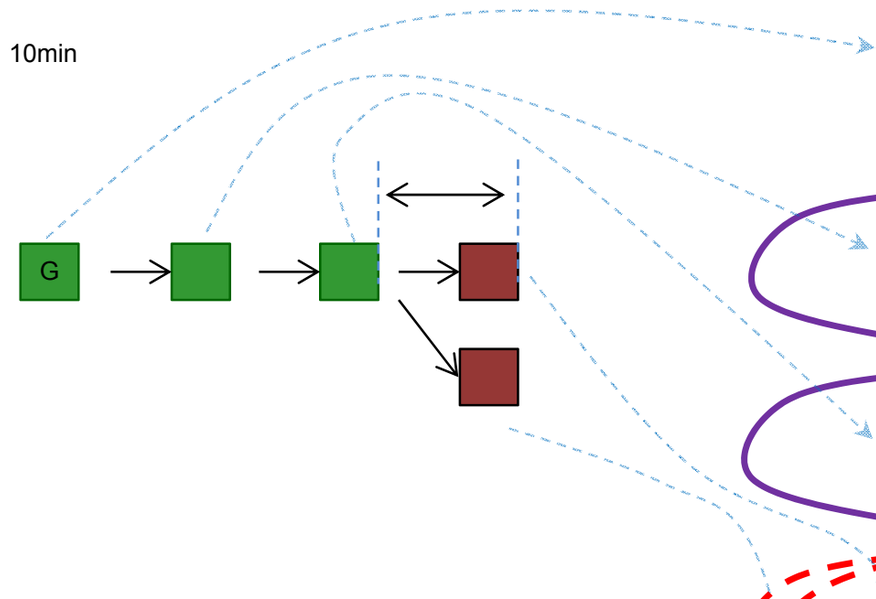
How a block becomes an orphan




```
===Service Robot Task Record===
data    : Genesis Block/ZenithConnectedRobots
nonce   : 0
prev    : 0
hash    : 57ebfa69e31520a6c8123b5a4ec550ccad1b297676b8fb661eab66c983637785

data    : {'SOBOT A - work code =': 1}
nonce   : 784623
prev    : 57ebfa69e31520a6c8123b5a4ec550ccad1b297676b8fb661eab66c983637785
hash    : 00000bd803c23f62024d896086d9291550aa99dcdae28b1b27ca3e3e18896769

data    : {'SOBOT B - work code =': 1}
nonce   : 807383
prev    : 00000bd803c23f62024d896086d9291550aa99dcdae28b1b27ca3e3e18896769
hash    : 000003a4cca8f5e20a0bc7719d1555b9d61fe0c06ba6ed911b0acb25b07e509c

data    : {'SOBOT A - work code =': 10}
nonce   : 297839
prev    : 000003a4cca8f5e20a0bc7719d1555b9d61fe0c06ba6ed911b0acb25b07e509c
hash    : 0000015a5f469c0ef734b346a955f420592c702dd831b6e2cdc8bac56b94e582

data    : {'SOBOT B - work code =': 10}
nonce   : 5957
prev    : 000003a4cca8f5e20a0bc7719d1555b9d61fe0c06ba6ed911b0acb25b07e509c
hash    : 00000ac51b2e80f354bb4486fa519c6af28291de19b2d8a24a6f2bb51e119e68
```

- The two blocks which are not added to the chain yet, are <u>valid</u> and <u>correct</u>. **But** no more than one block will be accepted to the chain. The rejected one(s) will be an *orphan block*.

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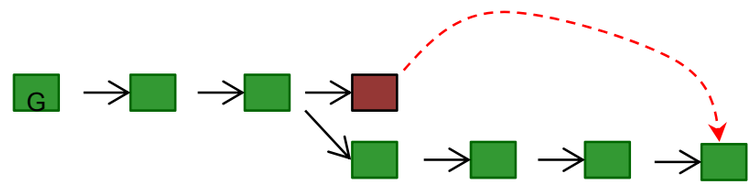
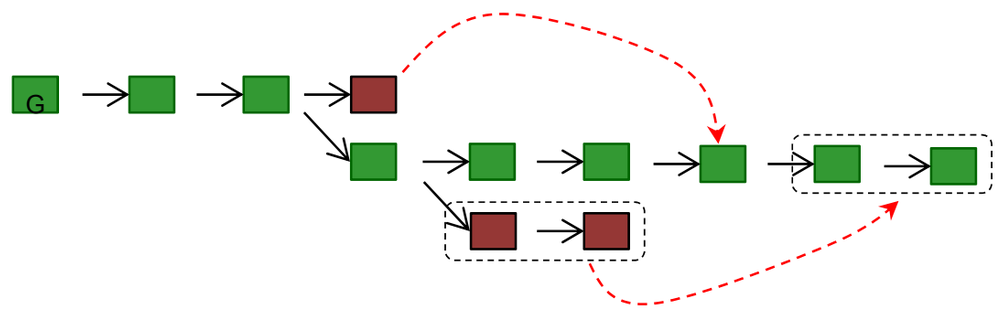
Examples

- Pre-cond.: Service Robots are recording their task status info on a block to add to the chain
- Service flow: Orphan block and its relocation to the chain; event1, event2,…
  -

Case #orp1



Case #orp2



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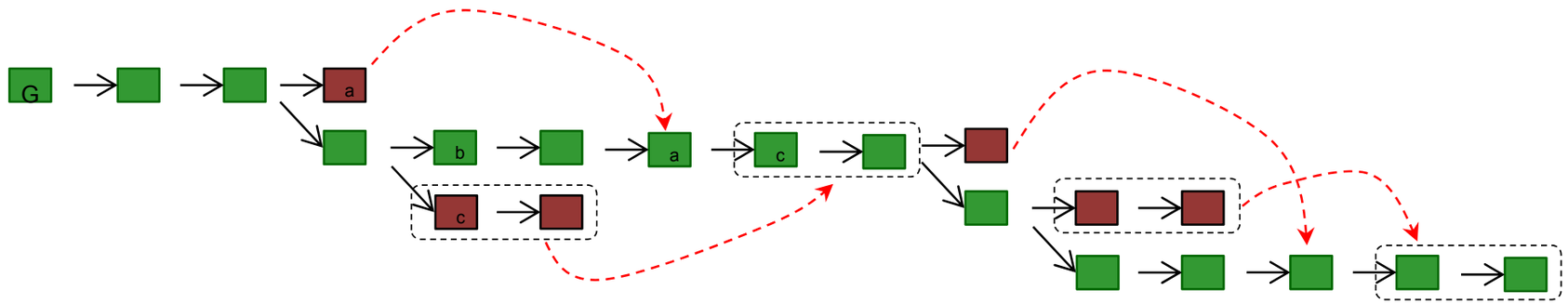
Examples (cont.)

- P#1: Is the timestamp of a block in the chain all in a chronological order?
  - In practice, No



- P#2: In a real-time or semi real-time service operation, is orphan block-caused degradation acceptable?
  - If not acceptable, is this the *cul-de-sac* of the DLT technology (e.g., for robotics applications)?

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Use case scenarios to study (1/)

- P#3: What if target is set low?
  - Difficulty is greater, block generation rate is lower → then orphan block generation rate is decreasing, is this claim correct?

- P#4: Any other service scenario to lower the orphan block generation rate?
  - Using transport layer interactions
  - Jointly optimized design (b/w 3GPP transport and DLT)

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Consideration Points

- Possible design considerations to derive stage-1 requirements
  - Delay of: sharing, making a block as another starting point of new transaction, etc.
  - Variance of (preferred performance measures): e.g., variance of delay (an old-aged task record will become available after a longer period of time)
  - Energy consumption (computation),

- **Objective #3 (out of SID proposal, 3171)**
- Transport-layer support for efficient distribution of task status information of multiple robots(e.g., when using distributed database such as DLT)

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