DeSceNt: Plug-based Decentralized Social Network

AeLoS (Nantes), ASAP (Rennes), CIDRE (Rennes), GDD (Nantes).

Descent Objectives

DeSceNt aims to ease the writing of distributed programs on a federation of plug computers.

- Plugs: cheap computers (35$)
- Federation: social interconnection of Plugs
- Writing programs for such infrastructure

How it look like

```
import cods.uc;
void main() {
  /* configure the network
  Network.configure(network);
  /* connect to the object
  Register x = new Register();
  Register x = UC.connect!Register("x");
  /* use x normally
  x.write(x.read() + 1);
}
```

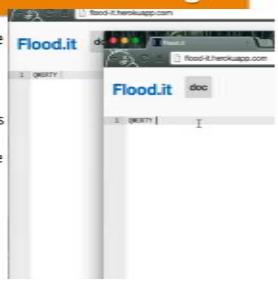
Connect a secure federation Thanks to task1,4 and 5

Access a federated data structure with weak consistency Criteria (Update Consistency) thanks to task 2&3

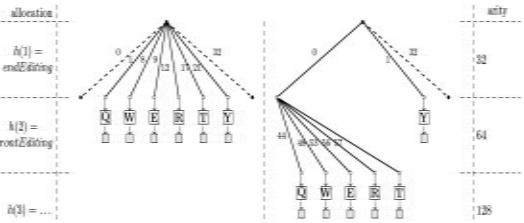
D program from task 3

Massive Collaborative Editing

- Each site has a copy of the shared sequence
  - Each site freely updates locally its own copy
  - Broadcast to others (thanks to task1,4,5 ;)
  - Each site integrates remote operations
  - System is correct if it at least eventually converges (or more see task3 ;)



Combine Exponential tree & random allocation



$O((\log n)^2)$ -> avoid to rebalance IDs...

New Criteria: Update Consistency

Update consistency

$$UC : T \mapsto \{H \in \mathbb{H} : Write4Ever \vee Converge\}$$

$Write4Ever \equiv |H_U| = \infty$

$Converge \equiv \exists Q' \subset H_Q$ finite: $\lim(H_{E_H \setminus Q'}) \cap L(T) \neq \emptyset$

Not UC -> cannot have 1 and 2 together ! UC !

- All UQ-ATDs can be implemented in a partitionable system

http://www.descent.cominlabs.ueb.eu/

Consistency Criteria Cartography

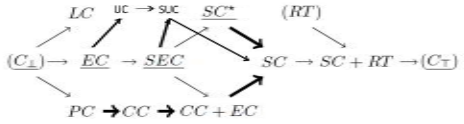
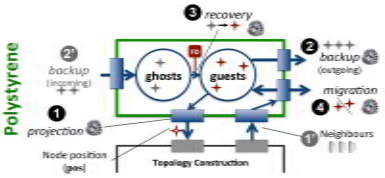


Figure 10: A summary of the criteria exposed in this article. The underlined criteria are composable. An arrow between C_1 and C_2 express the fact that $C_1 \leq C_2$. This arrow is thick if no composable consistency criteria exists along it

PC: Pipelined; EC: Eventual;CC:Causally, SC: Sequentially; SEC: Strong Eventual ; LC:Locally;SC*: cache consistency; Real-time consistent;

Polystyrene Approach



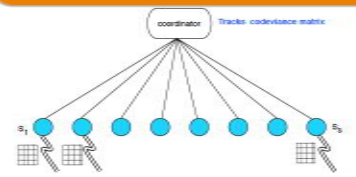
- Guests -> set of positions the node is in charge -> determine node position, nor migration...
- Ghost -> backup from others, if in failure -> reactivate as guest and re-backup...

Gossiping with Polystyrene

- Shape : 3D torus (replication K = 4)
- Round 20 : 50% correlated node crashes
- Round 100 : 50% node reinjection (repair)

Polystyrene recreates shape with surviving nodes

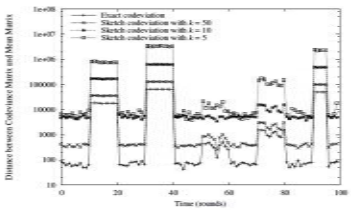
Codeviance between Streams



- Goal of the coordinator: computing the codeviance matrix, which represents the dispersion matrix of the s streams.
- Let $\mathbb{X} = \{X_1, X_2, \ldots, X_n\}$ be the set of fingerprint vectors $X_1, \ldots, X_n$ describing respectively the streams $\sigma_1, \ldots, \sigma_n$.

$$\widehat{\Sigma} = \left[\widehat{\text{cod}}(X_i, X_j)\right]_{1 \leq i \leq s, 1 \leq j \leq s}$$

Streams analysis for attacks detection



- Distance $\|\Sigma_r - \mathbb{E}(\Sigma_r)\|$ as a function of round r with $\mathbb{E}(\Sigma_r) = ((r-1)\mathbb{E}(\Sigma_{r-1}) + \Sigma_r)/r$
- Different scenario of attacks have been conducted on $s = 10$ sites.

Conclusions

- DeScENt achieved important results:
  - An operational evaluation platform available
  - Communications: Polystyrene
  - Structure and consistency: LSEQ, Update-Consistency
  - Security: Stream-based Co-deviation computation
- And more to come...

Perspectives

- Towards a demo of DeSceNt contributions based on a 1M editor challenge
- Demonstrate how 1M of users can edit same documents concurrently on social infrastructure

http://www.descent.cominlabs.ueb.eu/

http://chat-wane.github.io/CRATE