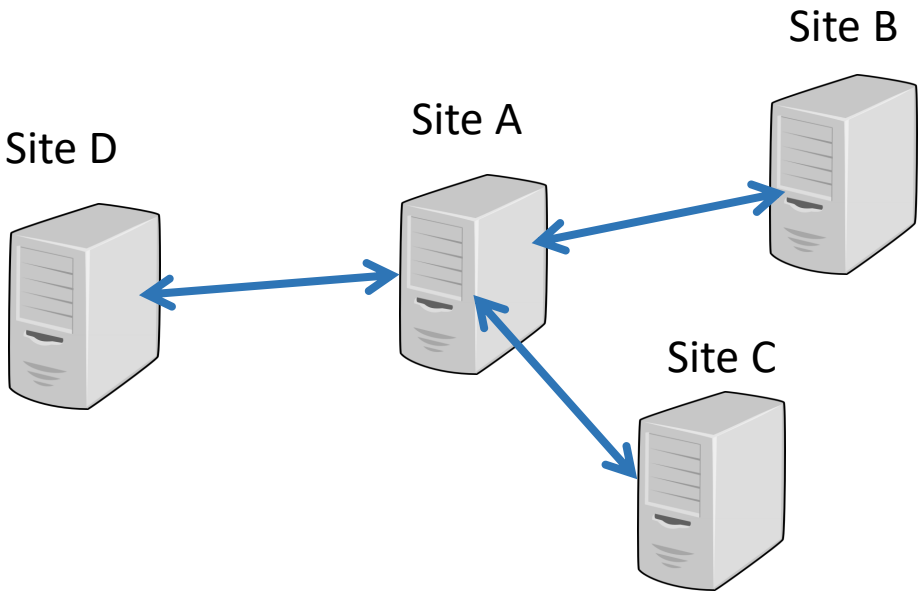
Samba KCC: Saying No to Full Mesh Replication

Garming Sam
Catalyst IT, Samba Team

What is the KCC?

- Knowledge consistency checker
- Used to manage replication connections in AD
- Set of algorithms to produce efficient network topologies



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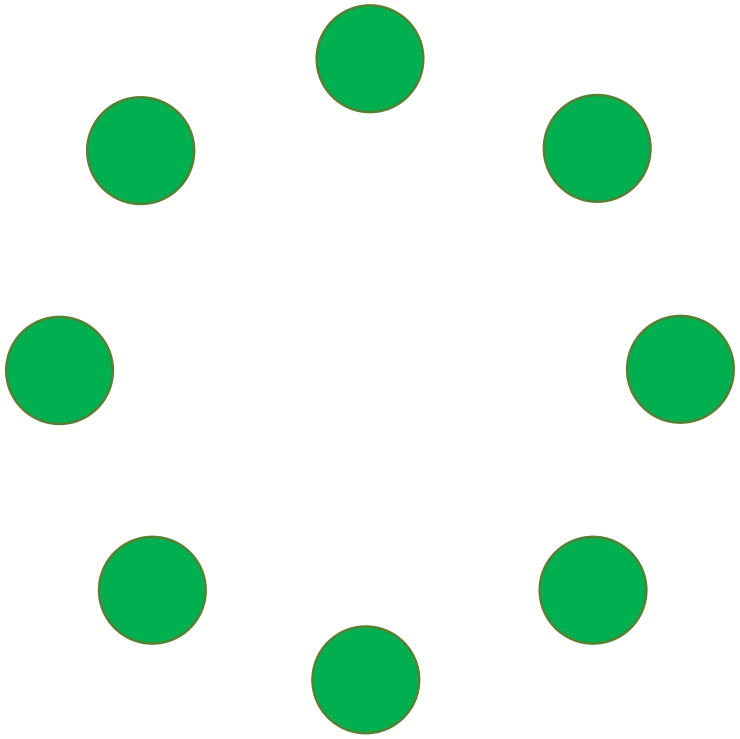

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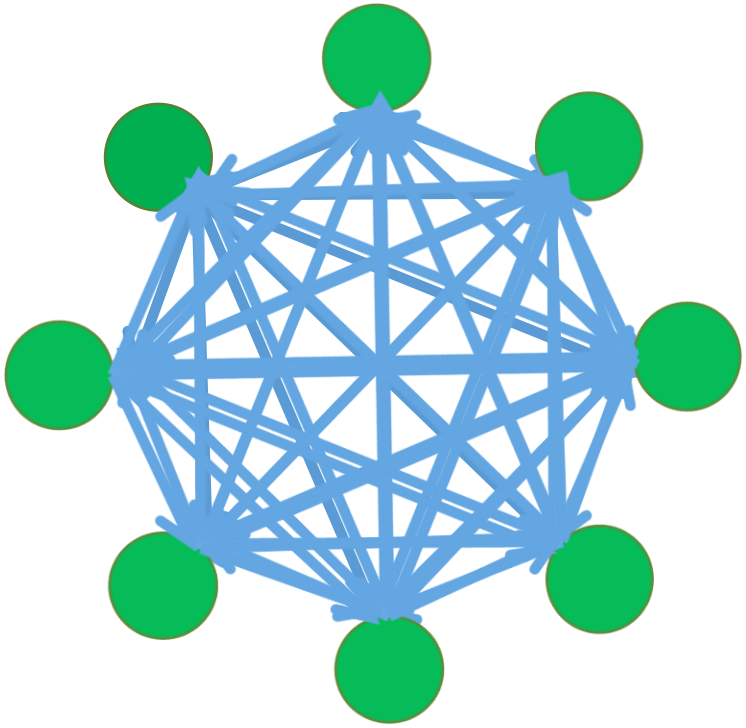

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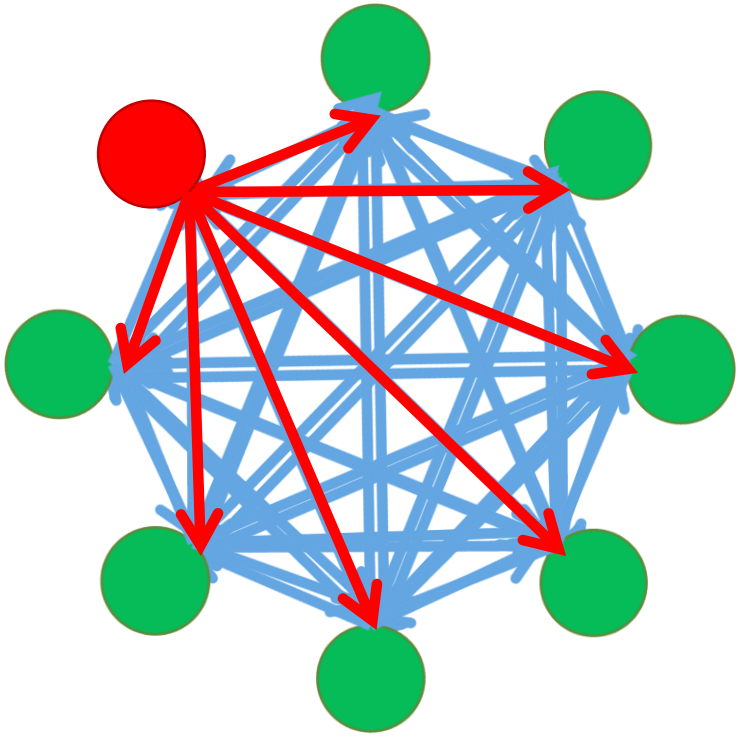

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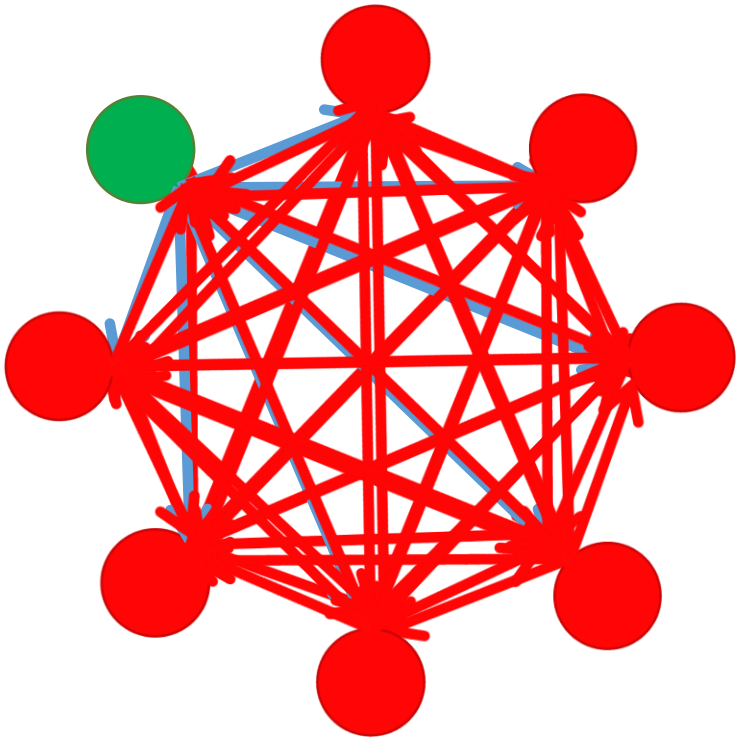


History of the KCC

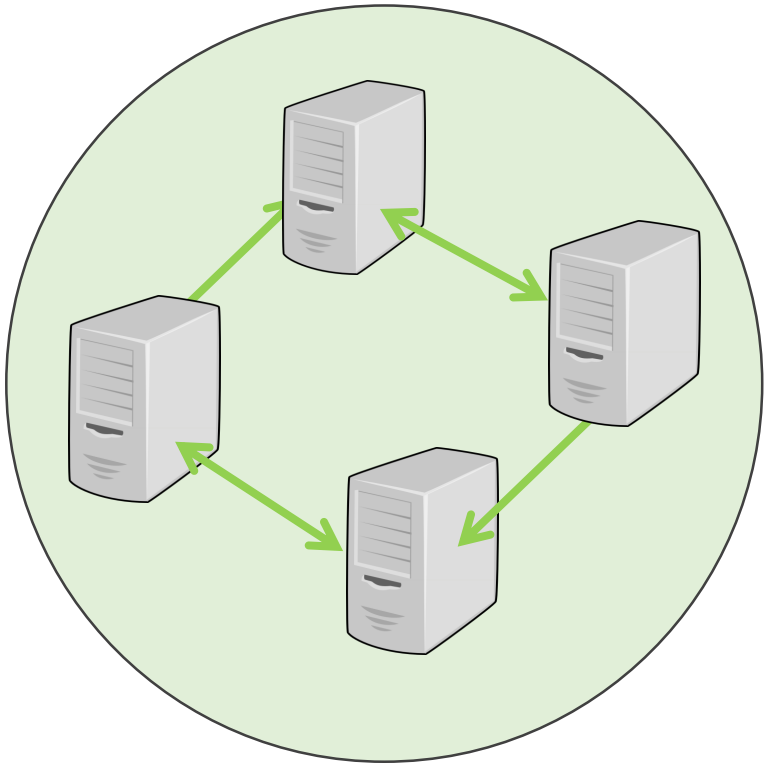
- Original full-mesh C code
- Attempt at MS-ADTS algorithms in C
- Dave Craft (2011) in Python inter-site algorithms
- Late 2014—Early 2015 Douglas and myself
- Samba 4.3 introduced, Samba 4.5 set as default

Stages of the algorithm

- Intra-site algorithm
- Inter-site algorithm
- Removing unneeded connections
- Translate connections

Intra-site algorithm

- Ring topology, with a few extra connections



Intra-site algorithm

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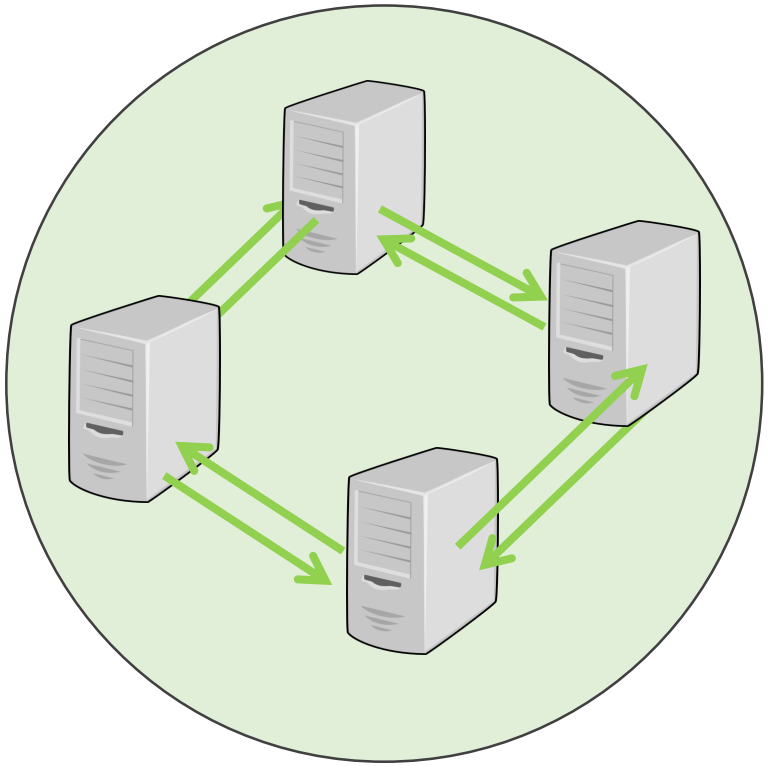
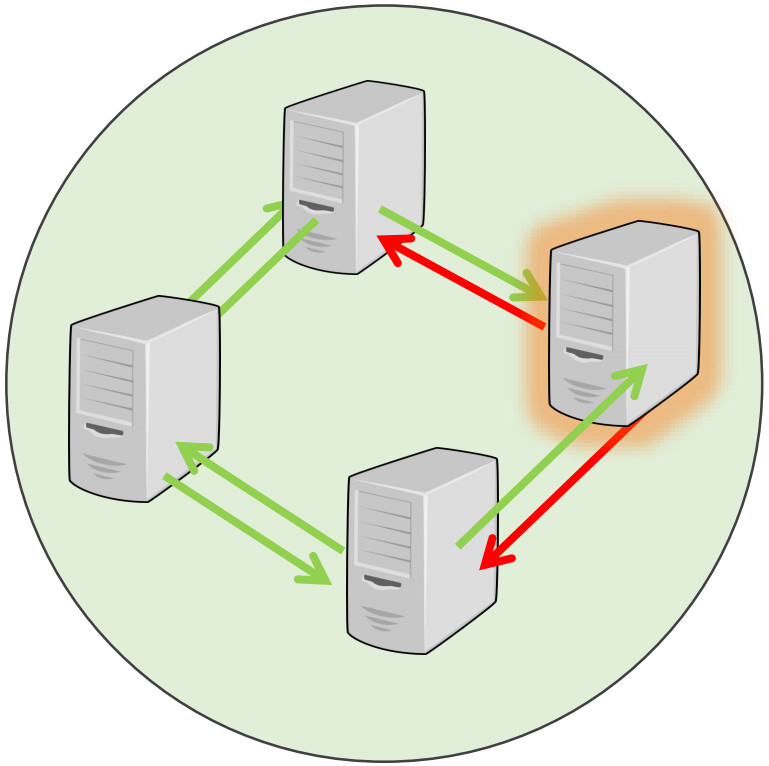


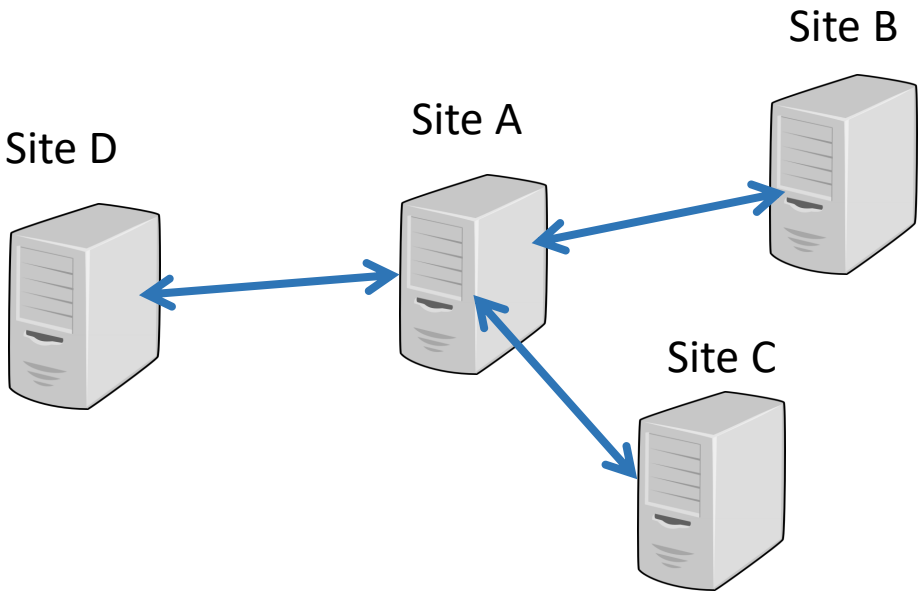
Intra-site algorithm

- Every DC in the site has a sorted list of site DCs



Inter-site algorithm

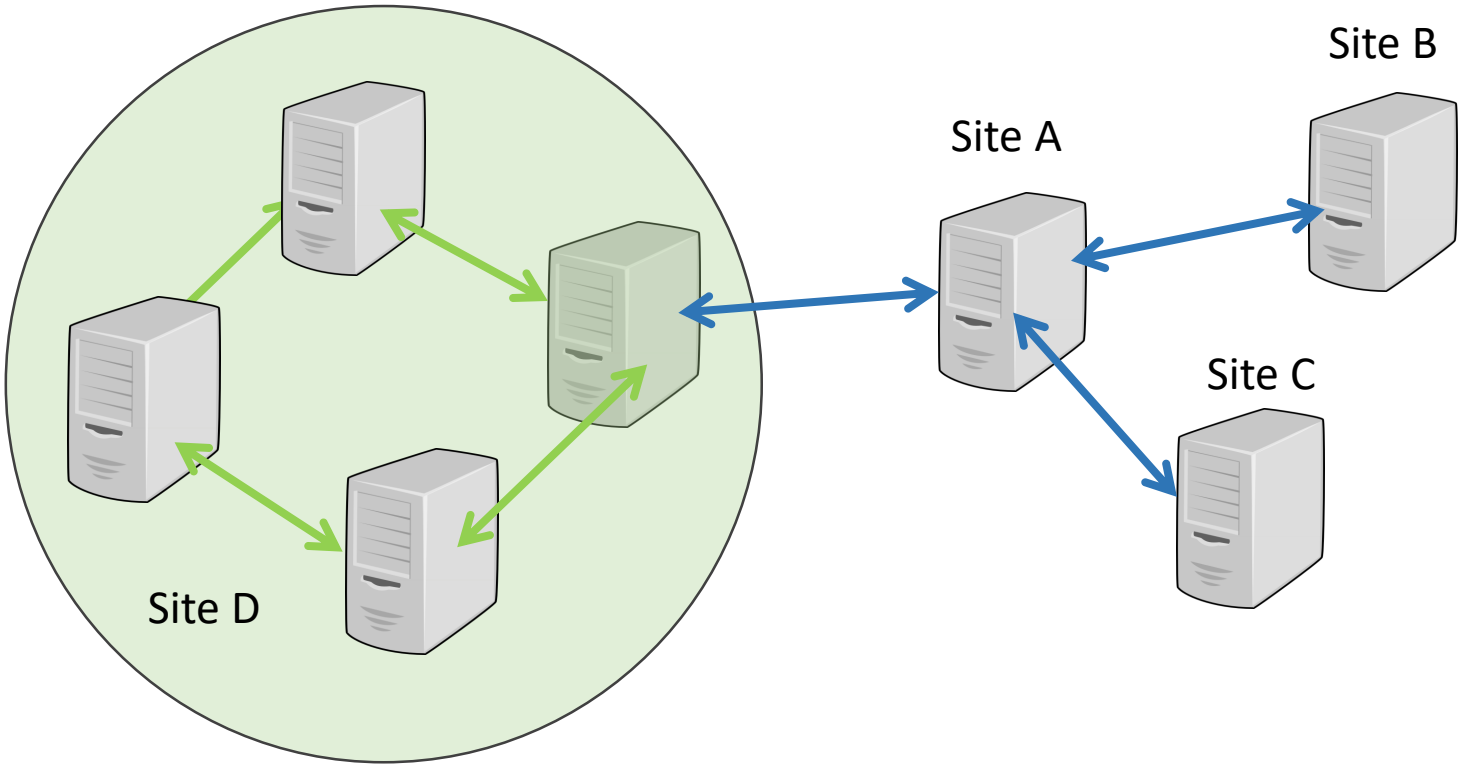
- Each site elects an inter-site topology generator (ITSG)
- Re-election attempts to occur if the ITSG is not responding
- Attribute: interSiteTopologyFailover



Inter-site algorithm

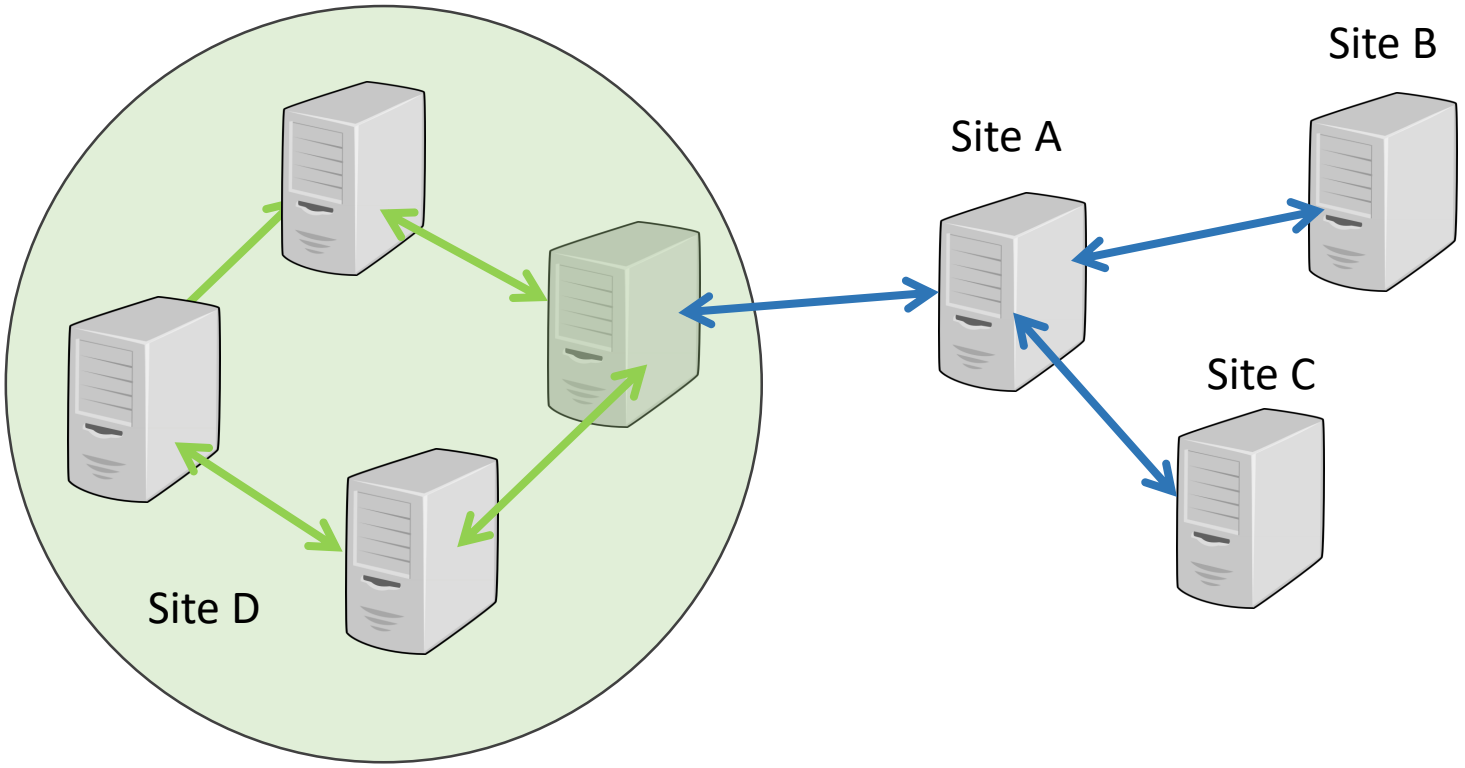
- Stable answer across entire DC network
- One DC per site managing inter-site connections
- Needs to be as fault tolerant as possible
- Must produce topology optimizing cost and schedules

Inter-site algorithm



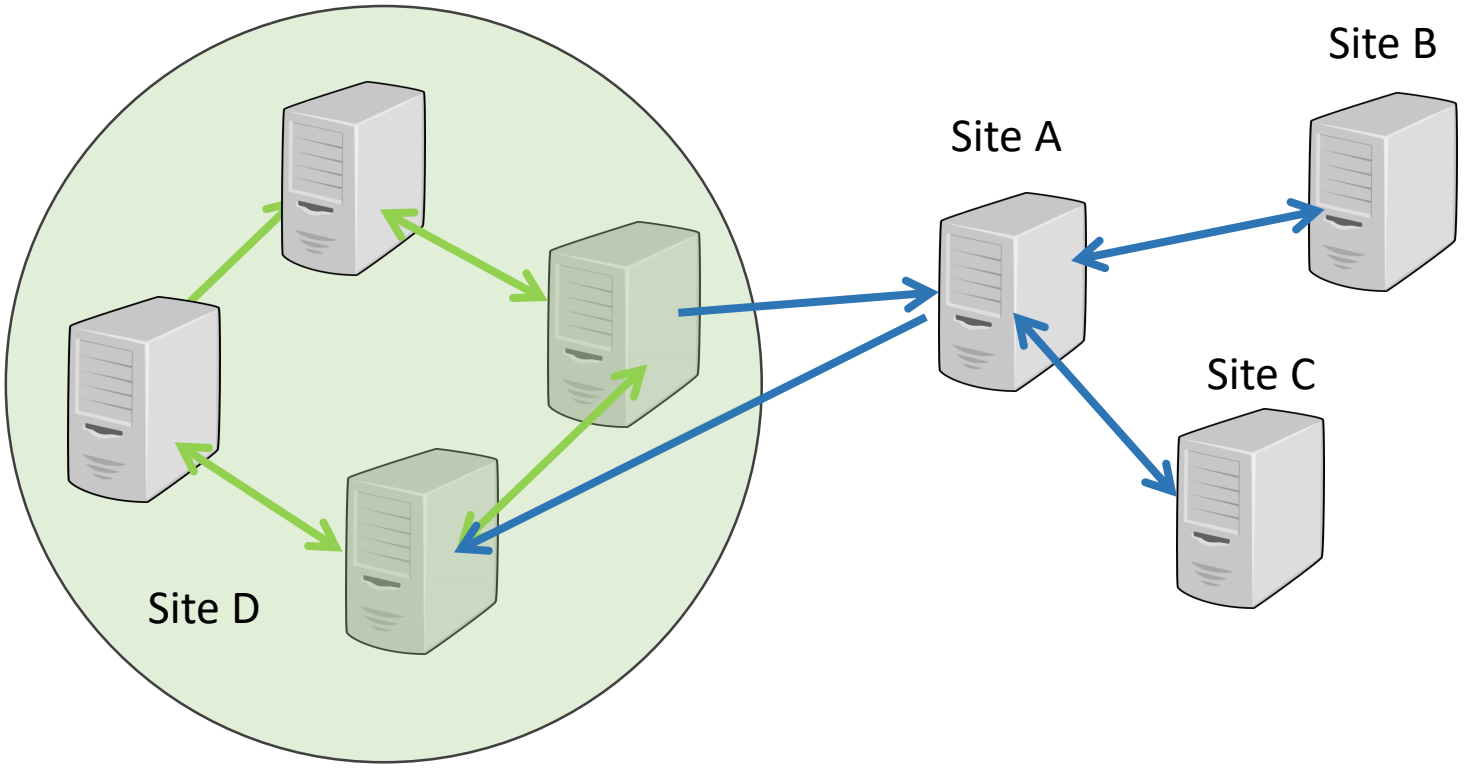
Bridgehead servers are the end-point connections between sites.

Inter-site algorithm



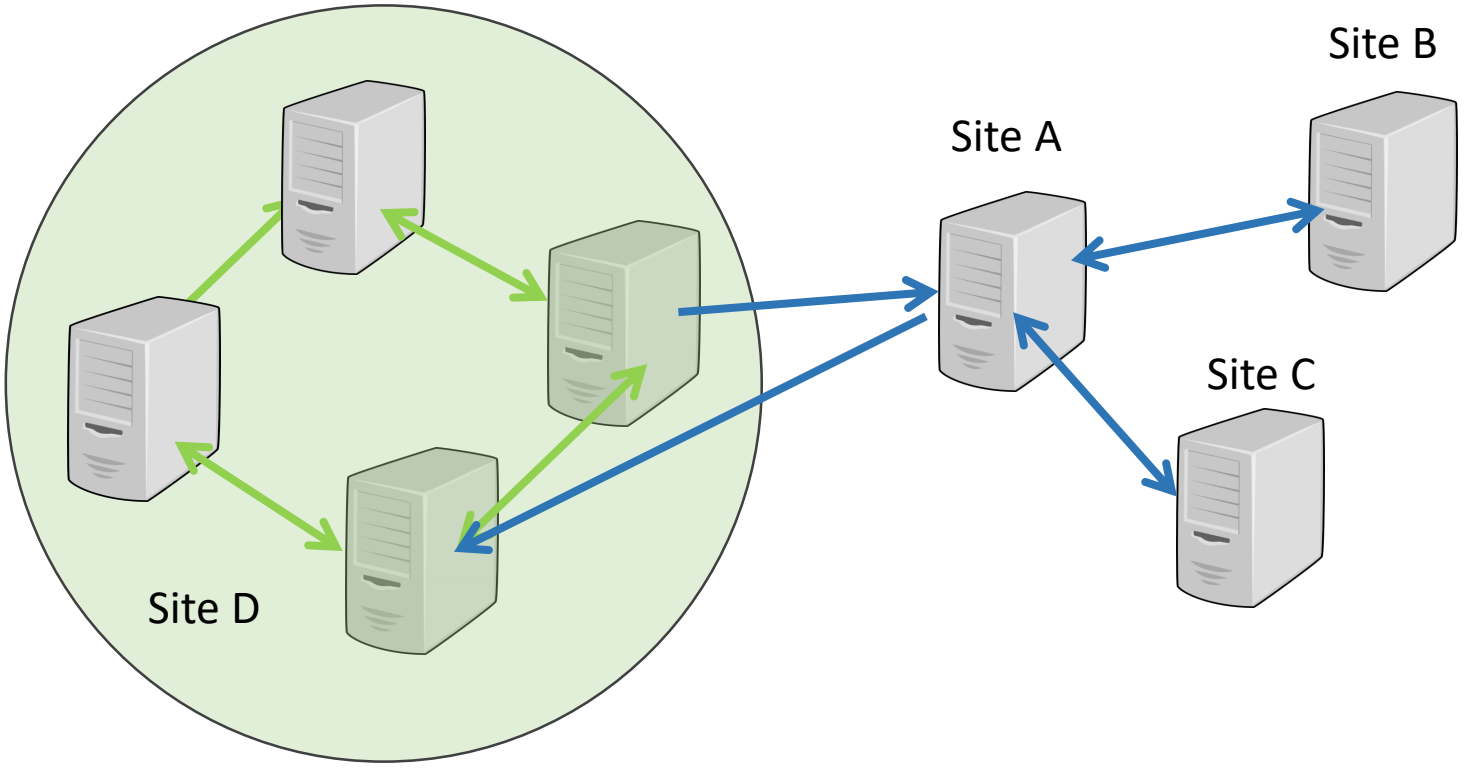
Being a bridgehead does not imply being an ITSG.

Inter-site algorithm



There is not necessarily a single bridgehead server.

Inter-site algorithm



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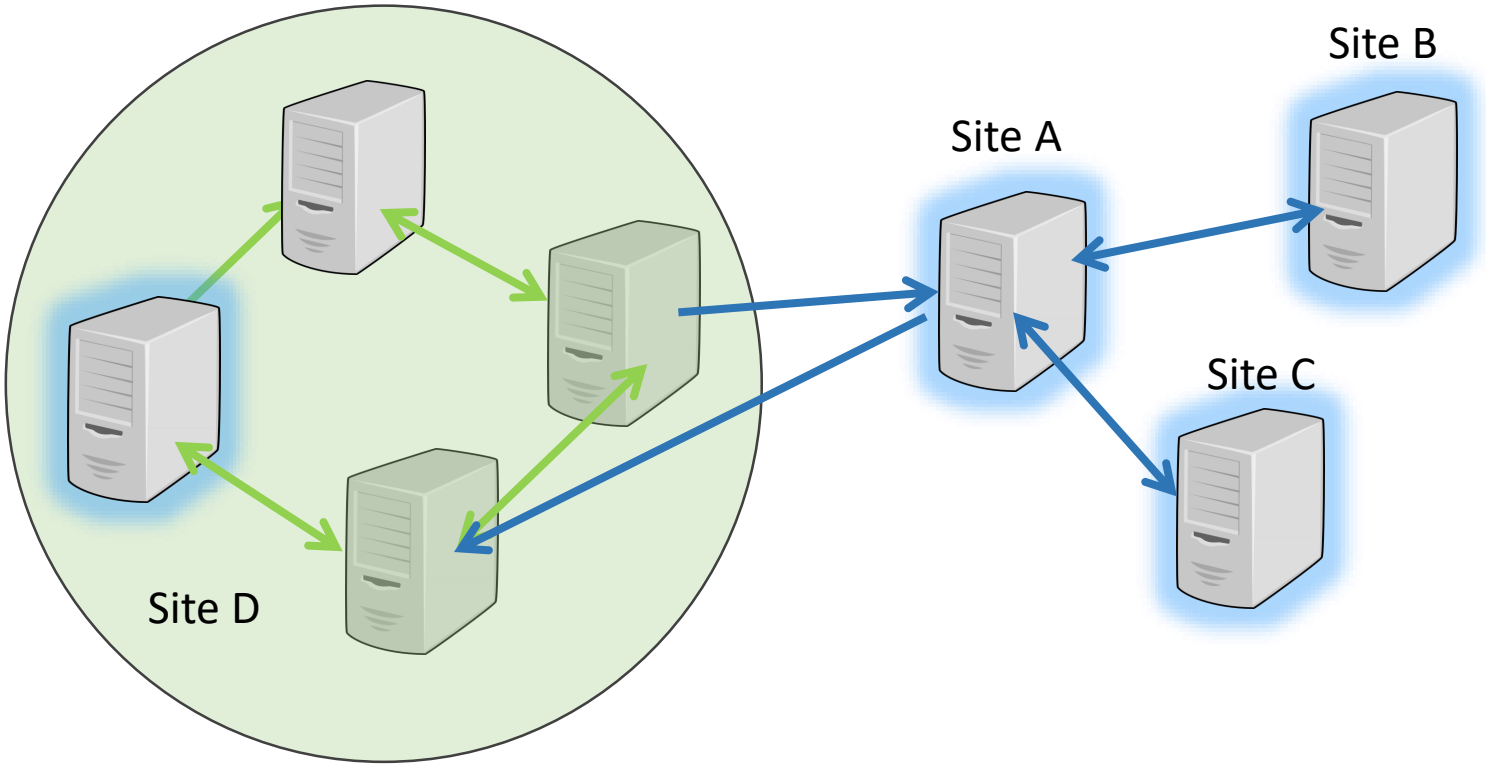
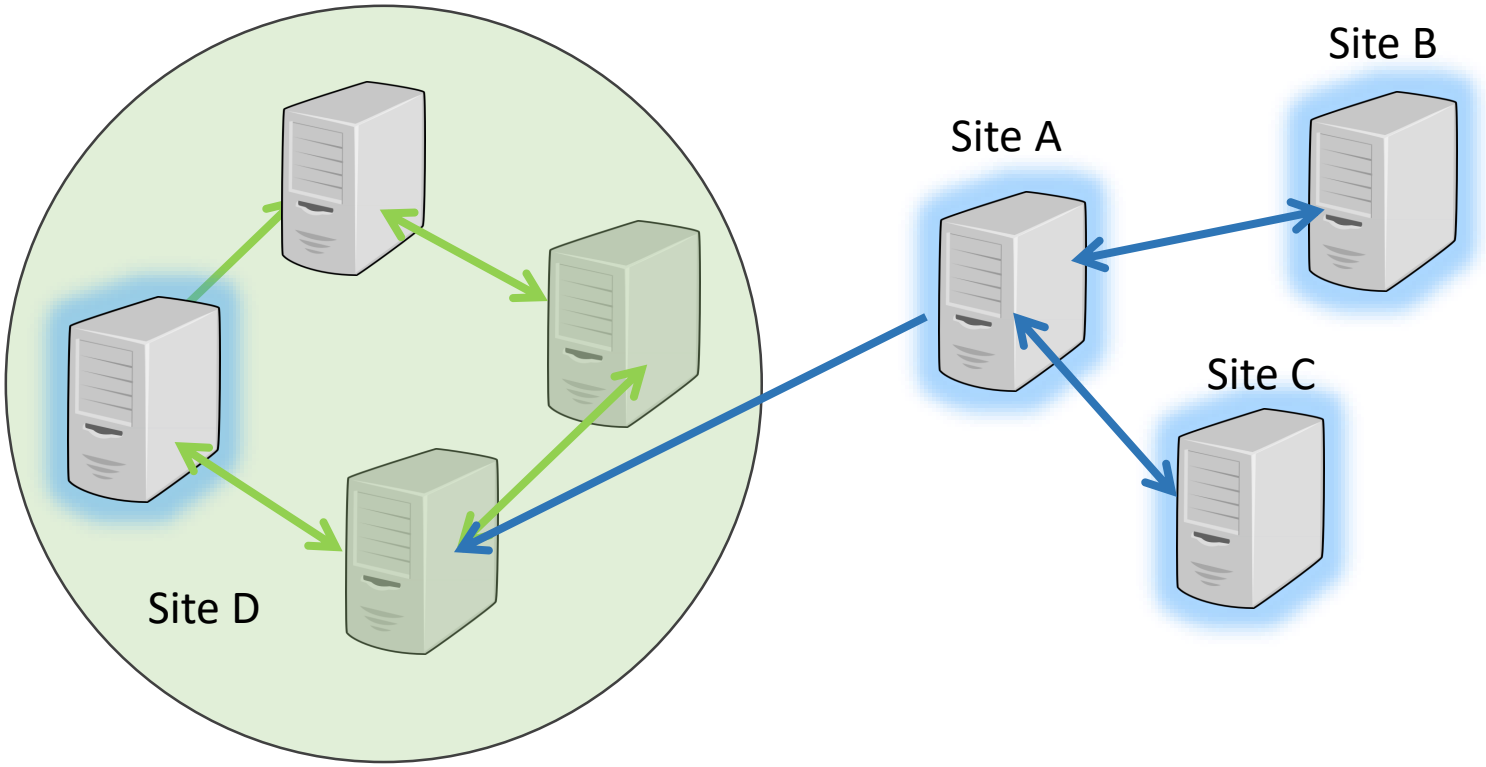
Inter-site algorithm

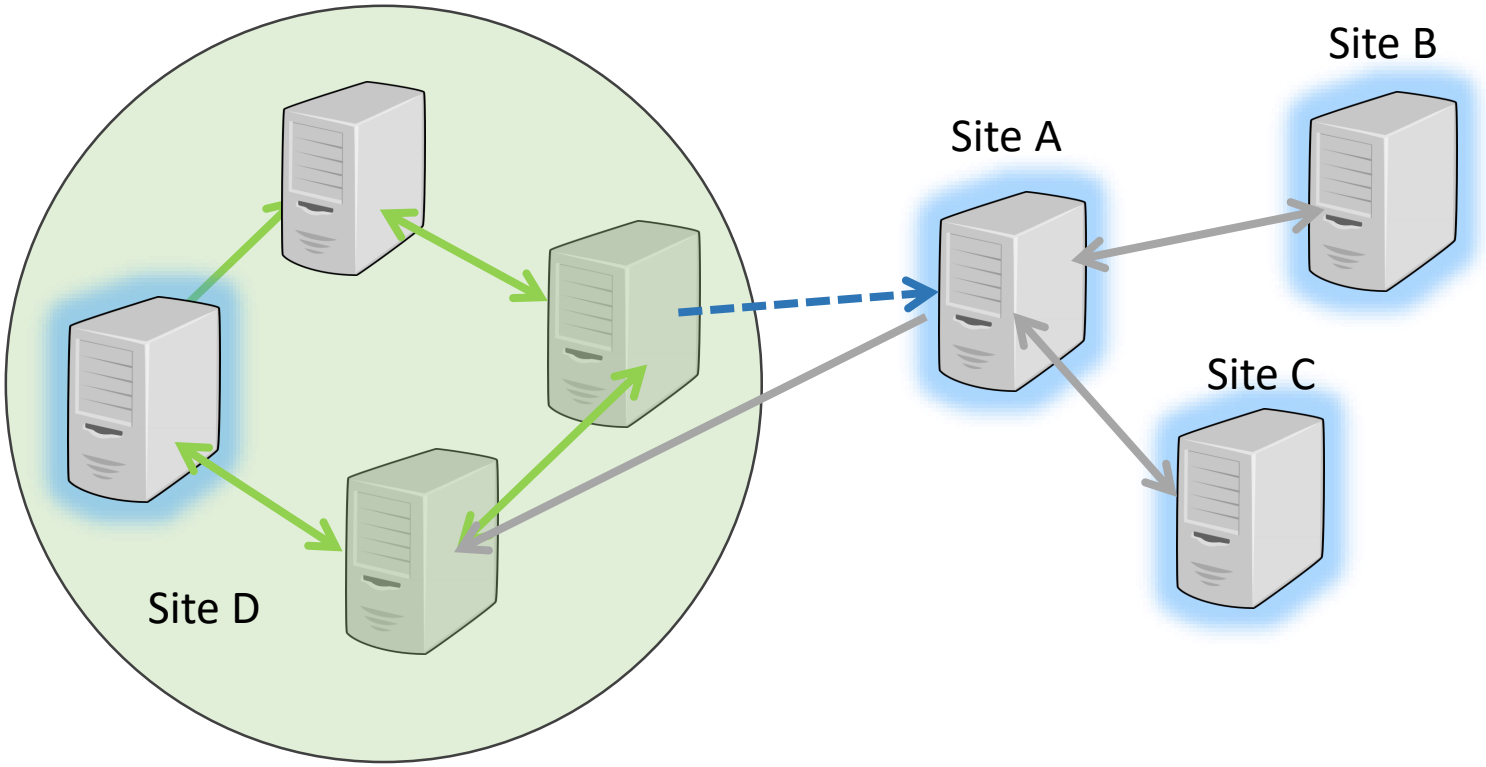


The inter-site algorithm only runs on the ITSG.

Inter-site algorithm

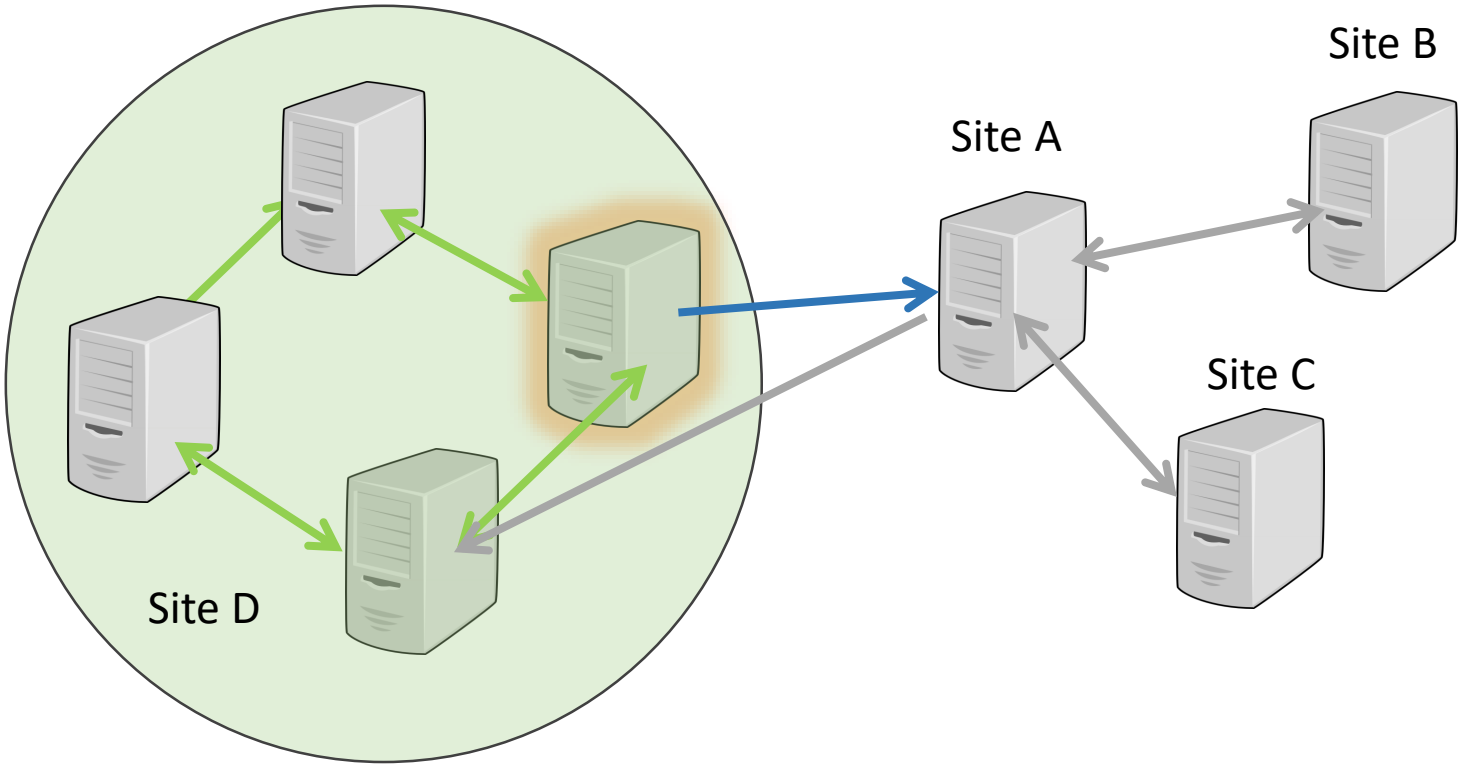


Inter-site algorithm



A new connection will be created in the database pointing to a randomly chosen bridgehead in Site A. Normal replication will propagate this to the necessary bridgehead in Site D.

Inter-site algorithm



The incoming bridgehead runs the KCC and notices the new connection.
It has no idea why it connects to the DC, that's the role of the ITSG.

Remove unneeded connections

- Stable answer across entire DC network
- Used to manage replication connections in AD
- Set of algorithms to calculate efficient network topologies
- ascending ReplInfo.Cost,
- descending available time in ReplInfo.Schedule,
- Overlapping schedule…

Two independent tasks running

- KCC running periodically
    - Creating NTDS Connection objects (ITSG or intrasite)
    - Translating NTDS Connections to repsFrom
- DREPL server
    - Reading repsFrom and pulling from the target

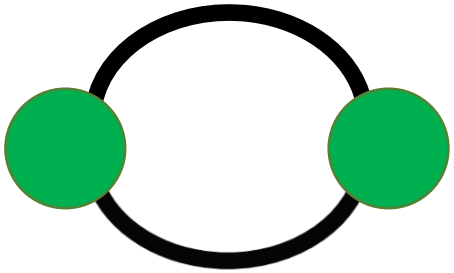
This means it can take some time to propagate.

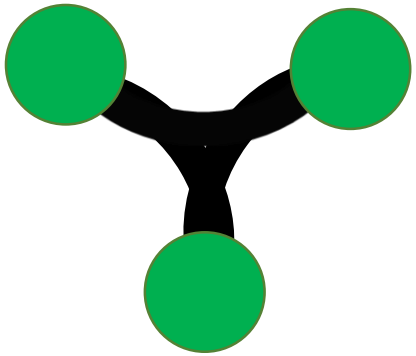
Translate connections

- Stable answer across entire DC network
- Used to manage replication connections in AD
- Set of algorithms to calculate efficient network topologies

Challenges

- Verbose documentation
- ‘Multi-edge’, hyper-edge?





Challenges

- Logical inconsistencies and omissions
- Pseudo-code vs textual description

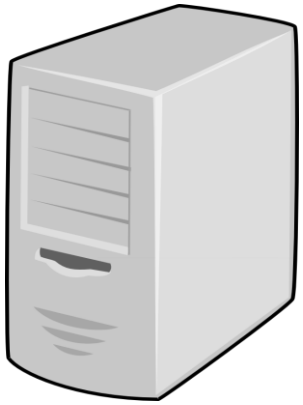
History of the Samba KCC

- Easy to debug your own bugs, not someone else
- Dot graph
- Avert some of these bounces outside of KCC

- With Samba 4.5, the new site-aware Samba Knowledge Consistency Checker (KCC) has been turned on by default. Instead of using full mesh replication between every DC, the KCC will set up connections to optimize replication latency and cost (using site links to calculate the routes). Although there is more effort required in establishing effective site topologies, it has enabled users to create larger and more distributed networks without any of the previous replication penalties. It has also meant that Samba AD can be aware of particular details of a network (such as satellite links or certain firewall restrictions) to ensure that information flows through the network in a reasonable way. The aim is to look at how sites in AD generally work, what role the KCC performs, and what implications this new feature has on a range of

- Hyperedge and hypergraphs

- Internal consitencies, it's hard to say what actually needs to be corrected.



```
.2637           # Step 1
.2638           self.refresh_failed_links_connections(ping)
.2640           # Step 2
.2641           self.intrasite()
.2643           # Step 3
.2644           all_connected = self.intersite(ping) # overlay a failed
network ontop of the expected
.2646           # Step 4
.2647           self.remove_unneeded_ntdsconn(all_connected)
.2649           # Step 5
```

.i1929 The KCC does not create more than 50 edges directed to a

.1930 single DC. To optimize replication, we compute that each node

.1931 should have n+2 total edges directed to it such that (n) is

.1932 the smallest non-negative integer satisfying

.1933 (node_count <= 2*(n*n) + 6*n + 7)

.Select ITSG

.1140 An intersite graph has a Vertex for each site object, a

.1141 MultiEdge for each SiteLink object, and a MutliEdgeSet for

.1142 each siteLinkBridge object (or implied siteLinkBridge). It

.1143 reflects the intersite topology in a slightly more abstract

.1144 graph form.

- White, red black color vertex