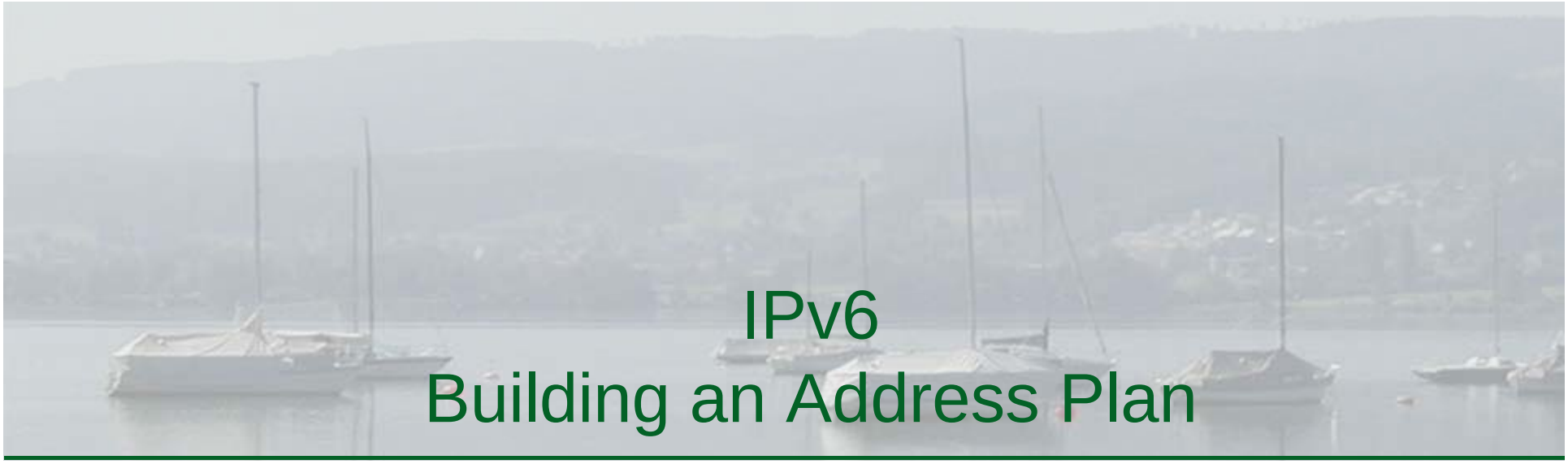

IPv6
Building an Address Plan

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Topics

- Where to start
- Guidelines
- Recommendations
- The Cost of a bad Address Plan

- References

Where to start

- We have an address plan, it has worked for over 10 years,
  let‘s just copy it
- IPv6 is not that different after all,
  let‘s just go ahead and make a plan
- You don‘t want to miss the opportunity
  to create the foundation for your future network carefully!
- Use the new architecture and the unlimited address space!

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Key Questions

- What has worked well with your IPv4 address plan and why?
- What would you do differently if you had the chance to redo it all? And why?
- What are the elements in your IPv4 address plan that you used for address conservation purposes?

Result

- Take the learnings from operating an IPv4 network into designing an IPv6 address plan
- Use all the rules you know:
  - Aggregation
  - Subnet Consistency
  - …..
- Get rid of all conservation rules (host counts)
- Value ease of administration over conserving address space. This results in saving operational cost!

Global Unicast Address

- Identified by the binary prefix 001 (2000::/3)

Global Routing Prefix	Value assigned to a site, Bit 0 – 2 set to 001
Subnet ID	Identifier assigned to a link within a site
Interface ID	Interface Identifier, 64 bit, following formats

Address Types

- An IPv6 address can be in one of 3 categories:
  - Unicast
  - Multicast
  - Anycast
- The broadcast address is not used anymore
- Addresses have scopes (link-local, site-local, global)
- Interfaces have multiple IPv6 addresses

Interface IDs

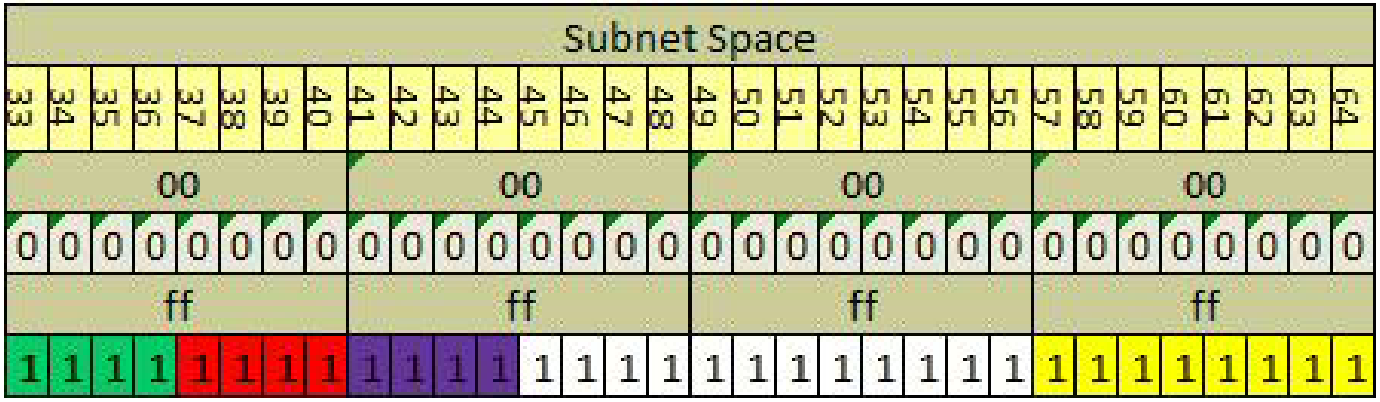
- **Interface ID**
  Interface Identifier, 64 bit, following formats
  - **EUI-64** Extend MAC address to 64 bits by adding FF FE between the 3rd and 4th Byte and “locally administered bit” must be set (2nd bit)
  - **Manual**
  - **Random (Privacy)**
  - **DHCPv6** static

- Choose traceability and ease of management (fixed IID) vs. anonymity (random IID changing in regular intervals)
- Consider using different method internally vs externally (verify address management tools! Talk to your vendors!)

Advanced Features

- More complex address architecture, multiple address/interface design – allows for new security models
- Higher scalability, less limitations such as broadcast domains – allows for new designs in the datacenter and cloud space
- Take the time to envision new architectures – consider valueing service-based design over topology-based design

Service-based vs topology-based Design



Use the green and red bits to differentiate services or locations/regions

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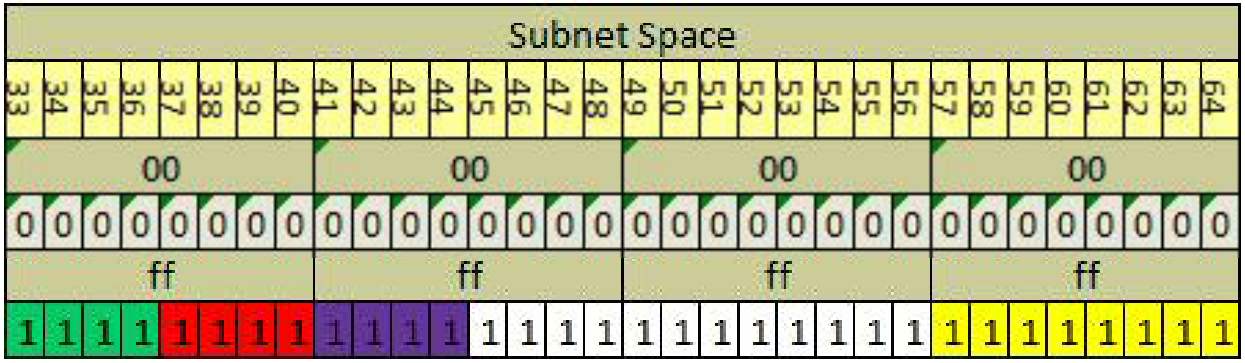
Service-based vs topology-based Design



1 Nibble = 4 bits

2^4 = 16 Options, 2^{12} = 4096 Options, 2^8 =256 Options

Green: 16 Service Types

Red: 16 Applications

Purple: 16 Superregions

White: 4096 Locations

Yellow: 256 Subnets per location

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What it takes

- Get really familiar with the architecture of IPv6 and the address architecture
  - Get thorough education
  - Build labs and play with it
- Test different scenarios, address allocation possibilities (SLAAC, DHCPv6, IPAM tools)
- Create a first draft of your address plan and plan for several reviews
- Plan for new types of services (sensorbased technologies, networked car, health care, infusion pumps)

Reviews

- Create different scenarios
- Discuss them with all groups involved (Wireless group, Datacenter and Cloud guys, Security……)
- Re-evaluate your drafts, converge them using all the feedbacks, create alternate scenario if necessary
- And redo the discussion process with all involved groups
- Consider using external consultants to either work on the drafts or review your final version before going production.

What does it cost?

- Time and ressources
  - Education, labs
  - Discussions and workshops
  - Consultants/Reviews

What does it save?

The cost of a bad address plan:

- Unneccesary operational cost (yearly returning)
  - Inconsistent or too complex address plan creates sources for errors
  - Security risk and performance loss because of complicated ACLs due to bad address structure
  - Unneccesary administrative overhead for management of overly complex address structure

- Or, your most expensive option, you may have to redesign your address architecture (guess what, this has happened to some) ;-)

General recommendations

- Minimize the number of prefix lengths categories (/48, /56)
- Reserve space for infrastructure (separate prefix range)
- Structure at nibble boundaries if possible
- Prioritize bit usage around design principles
- Aggregate as much as possible
- Don't use easy to discover and sequential IIDs
- Define addressing rules for all scopes
- Evaluate address management tools based on the demands of the addressing schema developed (make your vendors become creative with clear requirments!)

References and further reading

- RFC 4291, "IPv6 Addressing Architecture"
- "Preparing an IPv6 Addressing Plan",
  by Sander Steffann, RIPE
- "IPv6 Addressing Considerations", Cisco Systems
- RFC 5375, "IPv6 Unicast Address Assignment Considerations"

- Links on
  www.swissipv6council.ch/de/links/deployment-planning

Thank You For Your Attention!

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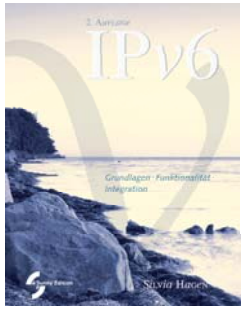

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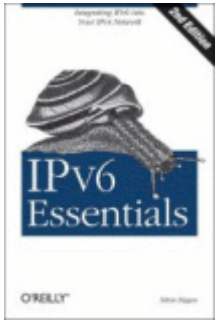

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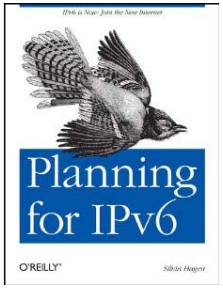

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