



N-Port ID Virtualization

NPIV

FCP Channel Virtualization in a Linux Environment

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FCP Channel Virtualization

- What is NPIV?
- New Possibilities
- Requirements
- Linux Support
- Getting Started
- Look 'n Feel

Terms and Definitions

- NPIV
 - N-Port ID Virtualization
 - IBM System z9 only!
- Channel
 - Physical FCP adapter
- Subchannel
 - Logical FCP adapter
 - Defined within IOCCDS or z/VM
- HBA
 - Host Bus Adapter (channel or subchannel, context-dependent)
- FC SAN
 - Fiber Channel Storage Area Network

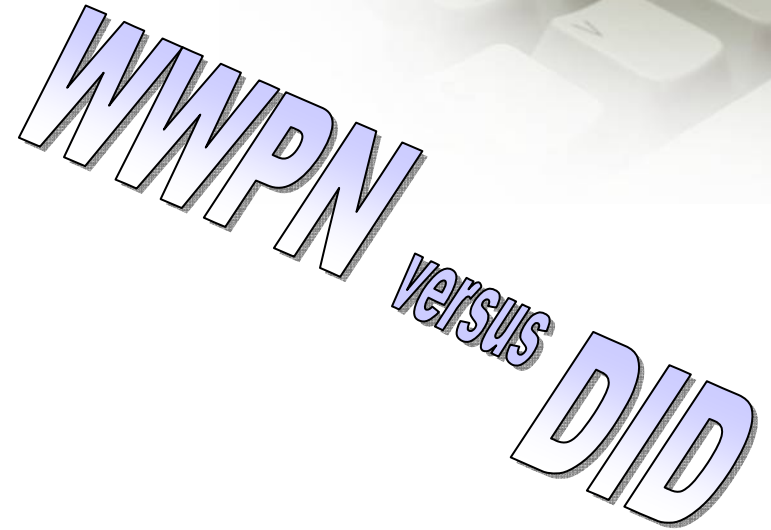
Terms and Definitions (cont.)

o WWPN

- Worldwide Port Name
- Worldwide unique identifier of a FC port
- „burned in“ during manufacturing
- 8 byte hexadecimal value
- E.g. 0x5005076401e06b18

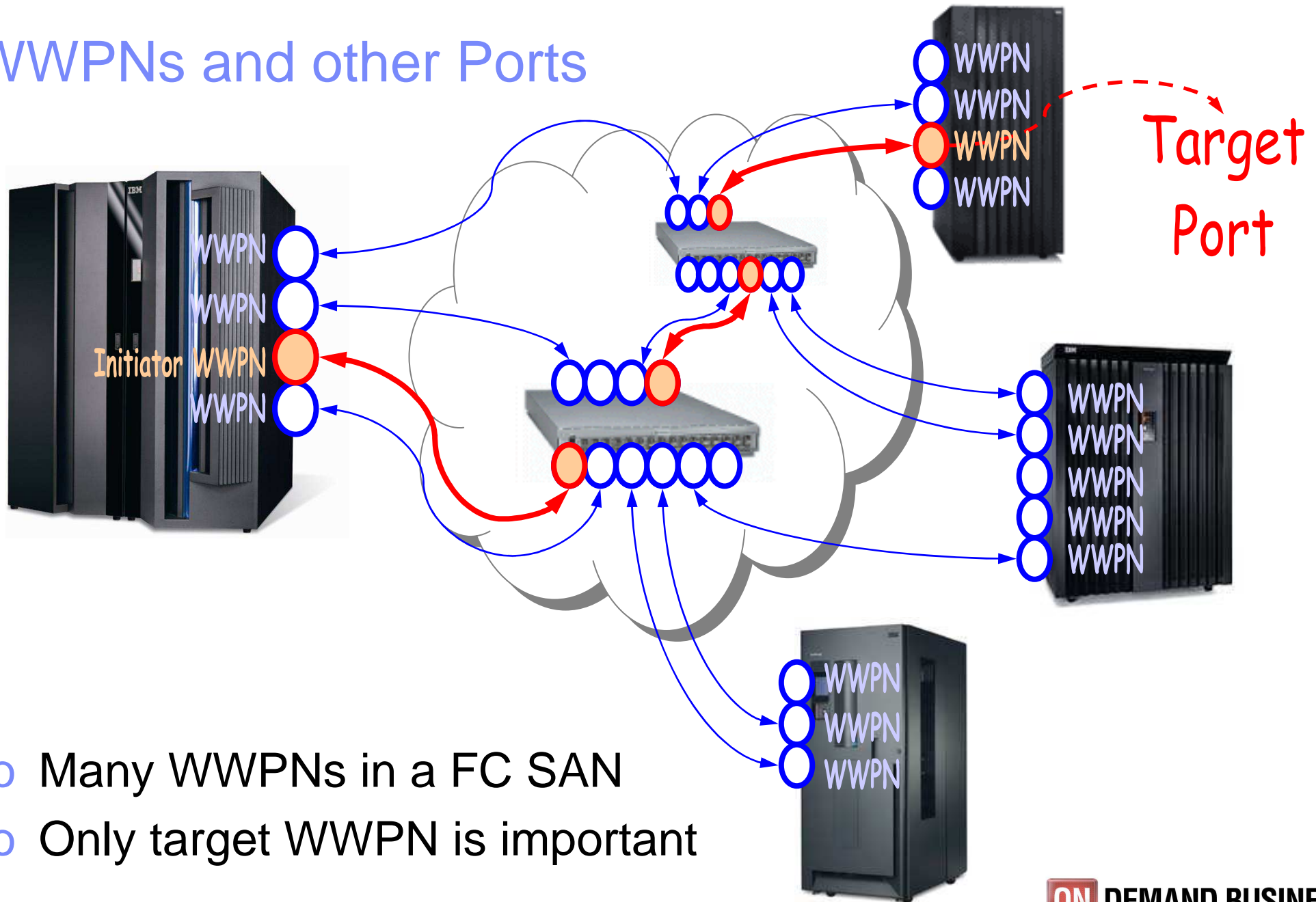
o D_ID

- Destination ID
- Used internally for active FC connections instead of WWPNs
- 3 byte hexadecimal value
- Assigned by FC switch
- E.g. 0x2a036bc



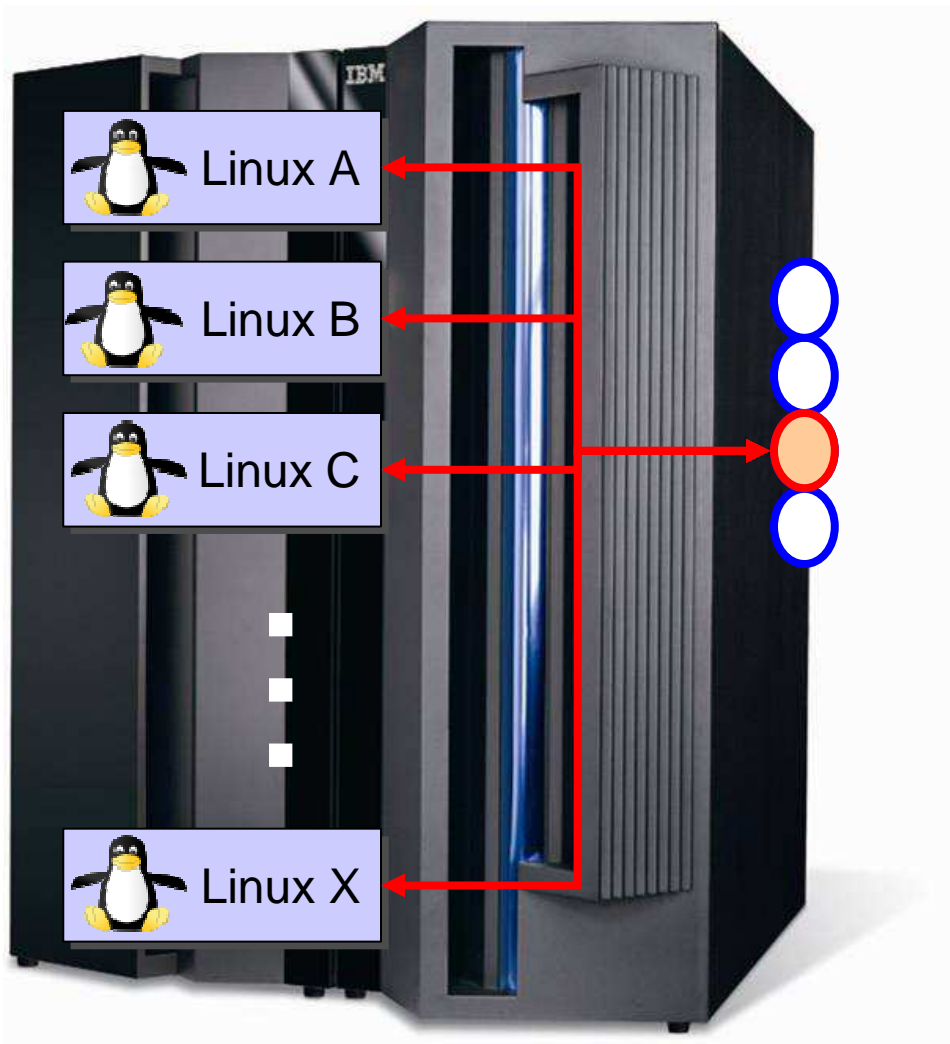
WWPN versus DID

WWPNs and other Ports



- Many WWPNs in a FC SAN
- Only target WWPN is important

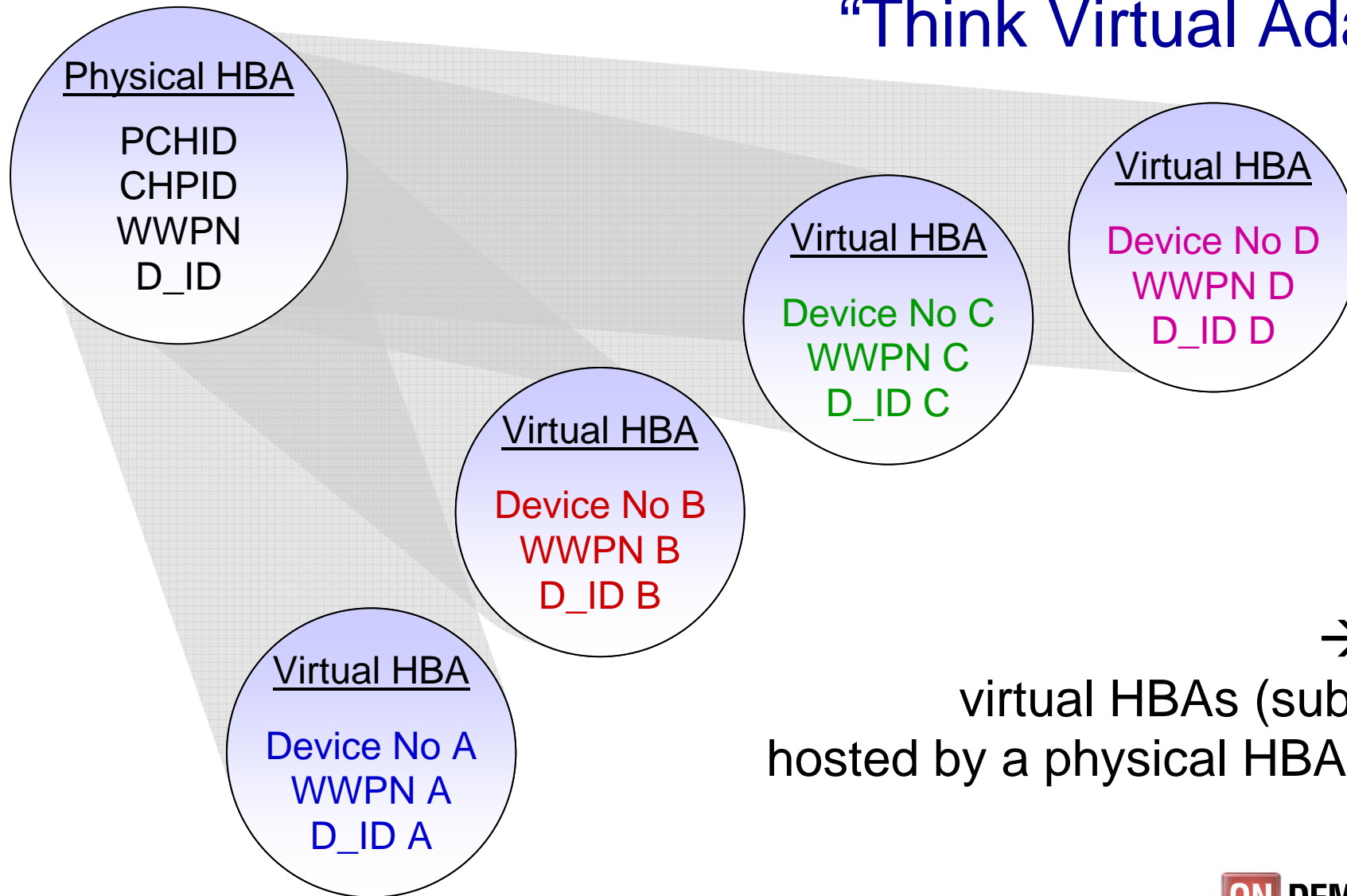
What is NPIV?



- Initiator Port
 - has attributes like:
 - WWPN
 - D_ID
 - PCHID
 - CHPID
 - ...
- Without NPIV: All channel attributes will be duplicated for each subchannel

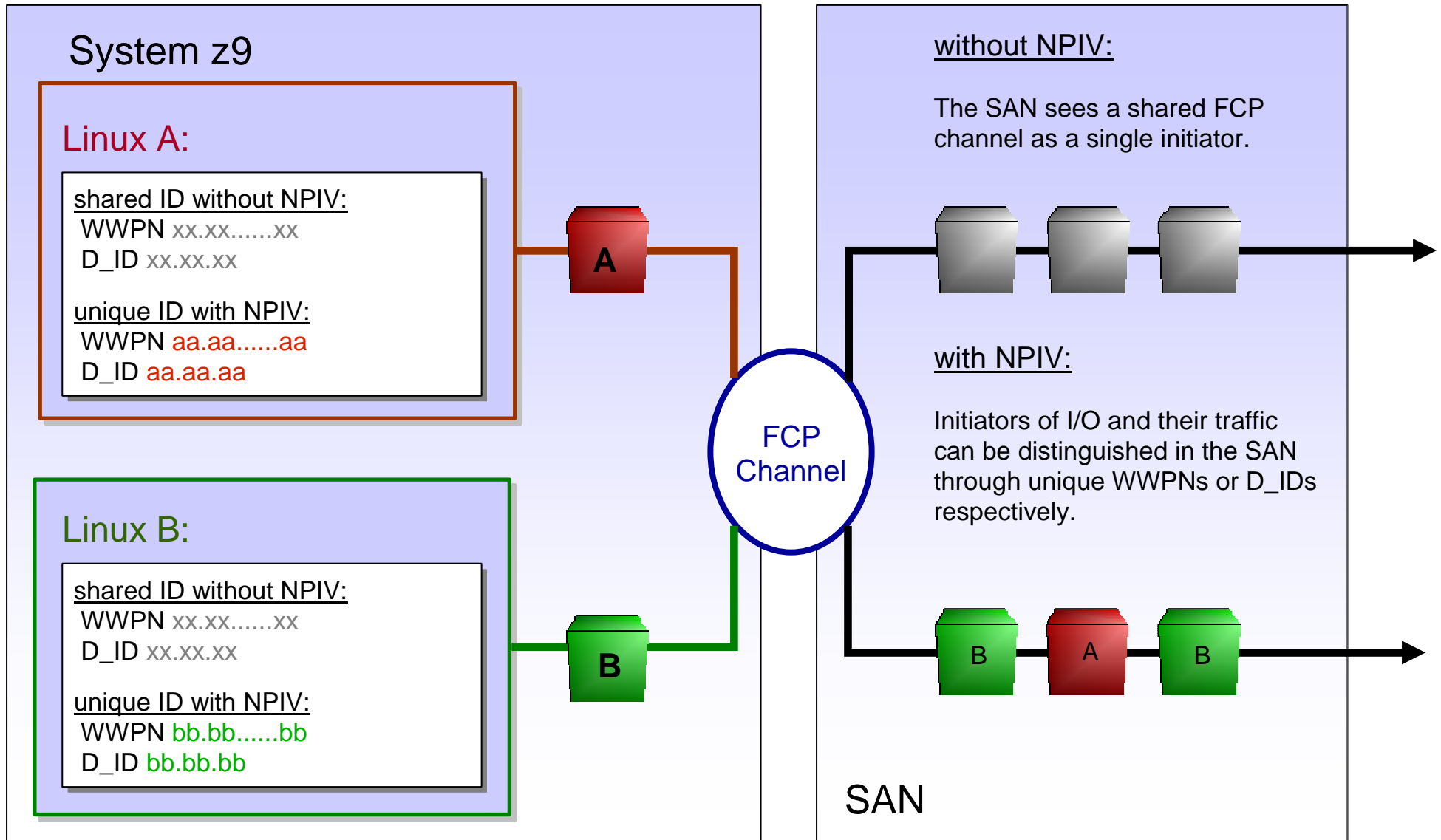
What is NPIV?

“Think Virtual Adapters”



→ concept:
virtual HBAs (subchannels)
hosted by a physical HBA (channel)

What is NPIV?



What is NPIV?

Industry-Standard Solution

- NPIV = N-Port Identifier Virtualization
- Standard-based approach being embraced by the industry
- System z9 persistently assigns unique WWPN to each FCP subchannel
- FCP Channel obtains separate D_ID for each subchannel from fabric switch
- result: unique SAN identity for each FCP subchannel

see
also

Fiber Channel - Framing and Signaling Interface (FC-FS)

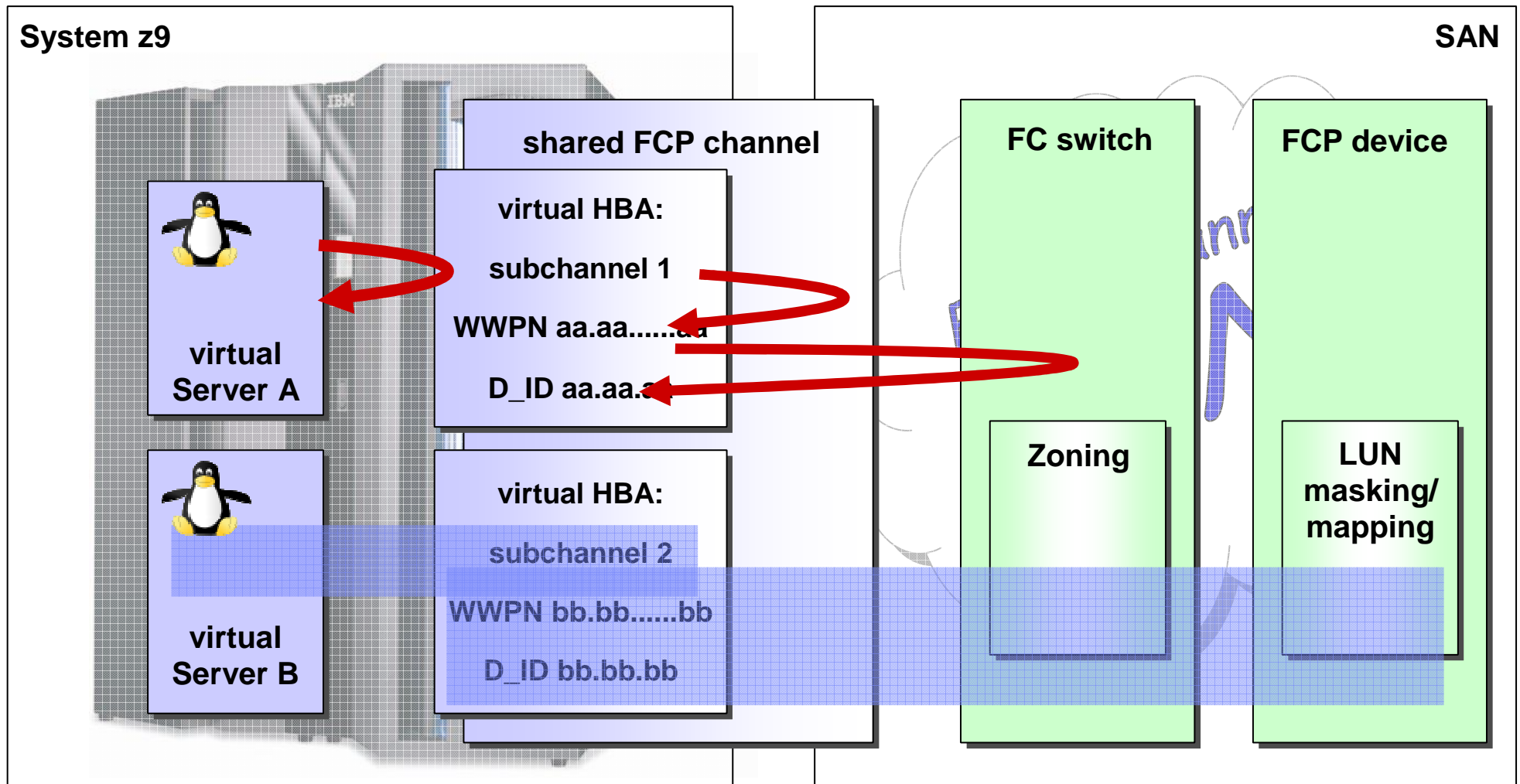
<http://www.t11.org>

 **ON DEMAND BUSINESS**

What is NPIV?

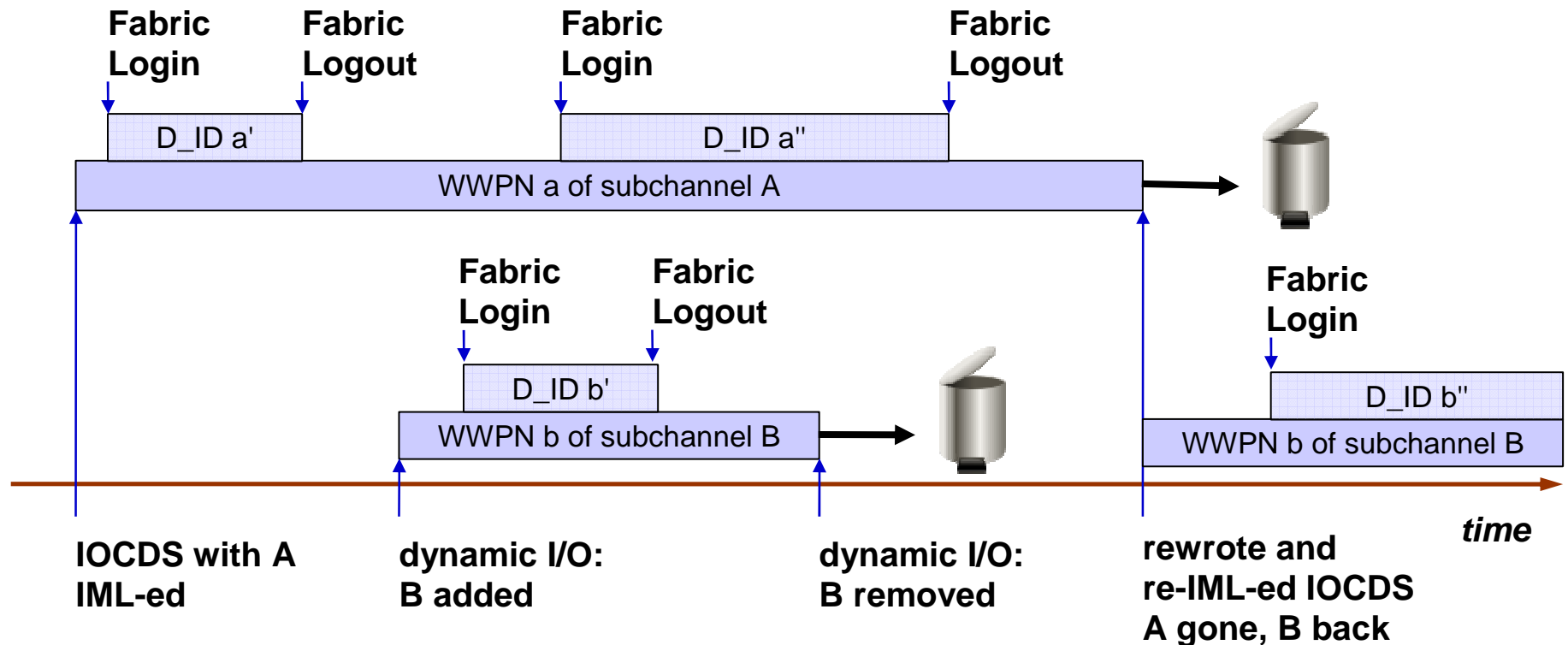
System z9 Implementation

- o Connecting a virtual HBA to the SAN



What is NPIV?

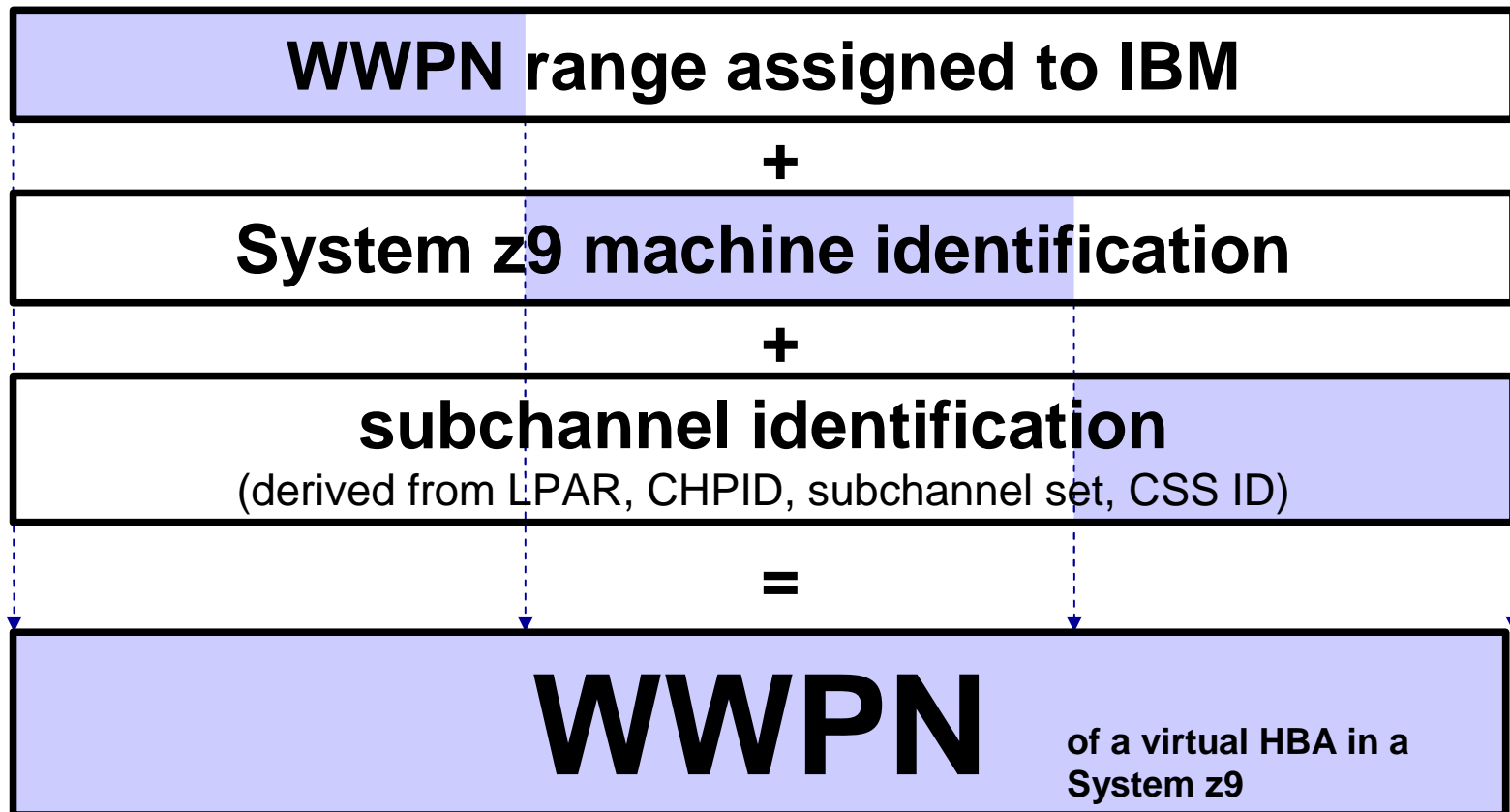
System z9 Implementation



- Lifetime of virtual WWPN = lifetime of subchannel definition
- D_ID lifetime = fabric connection lifetime

What is NPIV?

System z9 Implementation

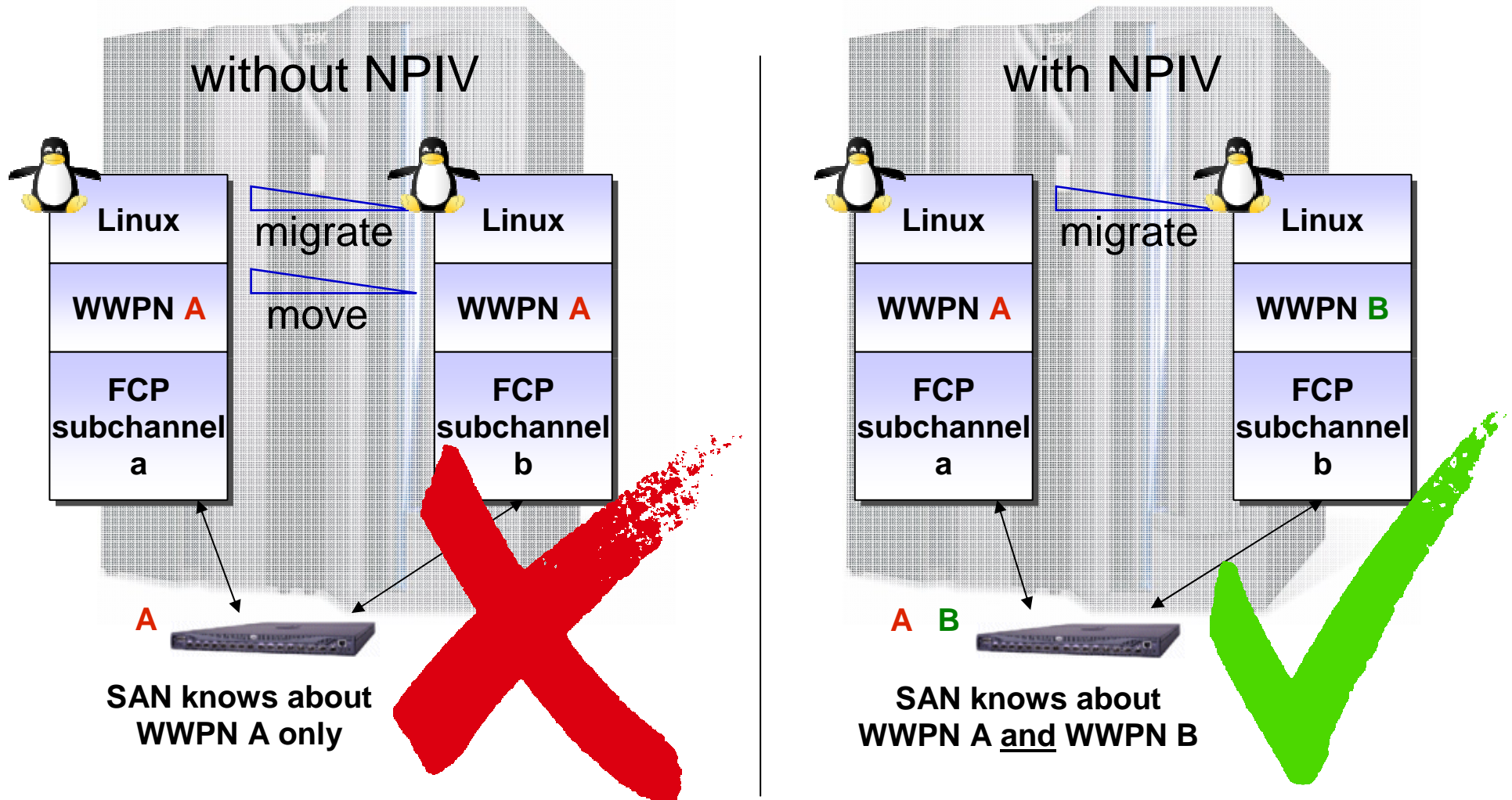


- well-defined “ingredients” tie a unique WWPN permanently to a subchannel

What is NPIV?

System z9 Implementation

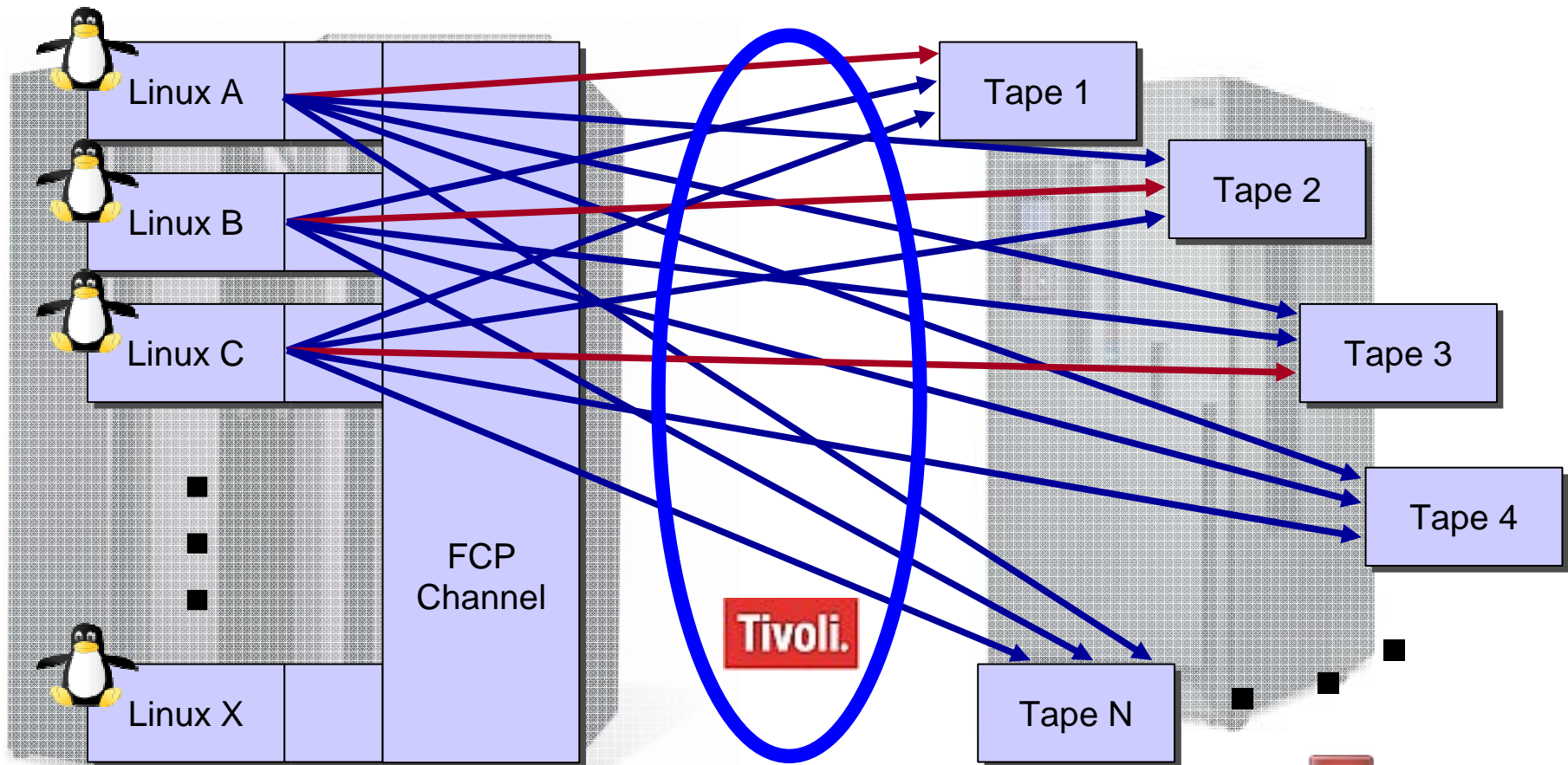
- Migrating Linux changes WWPNs



New Possibilities

'Exclusive LUN' policy eliminated

- o Many-to-many tape backup solutions

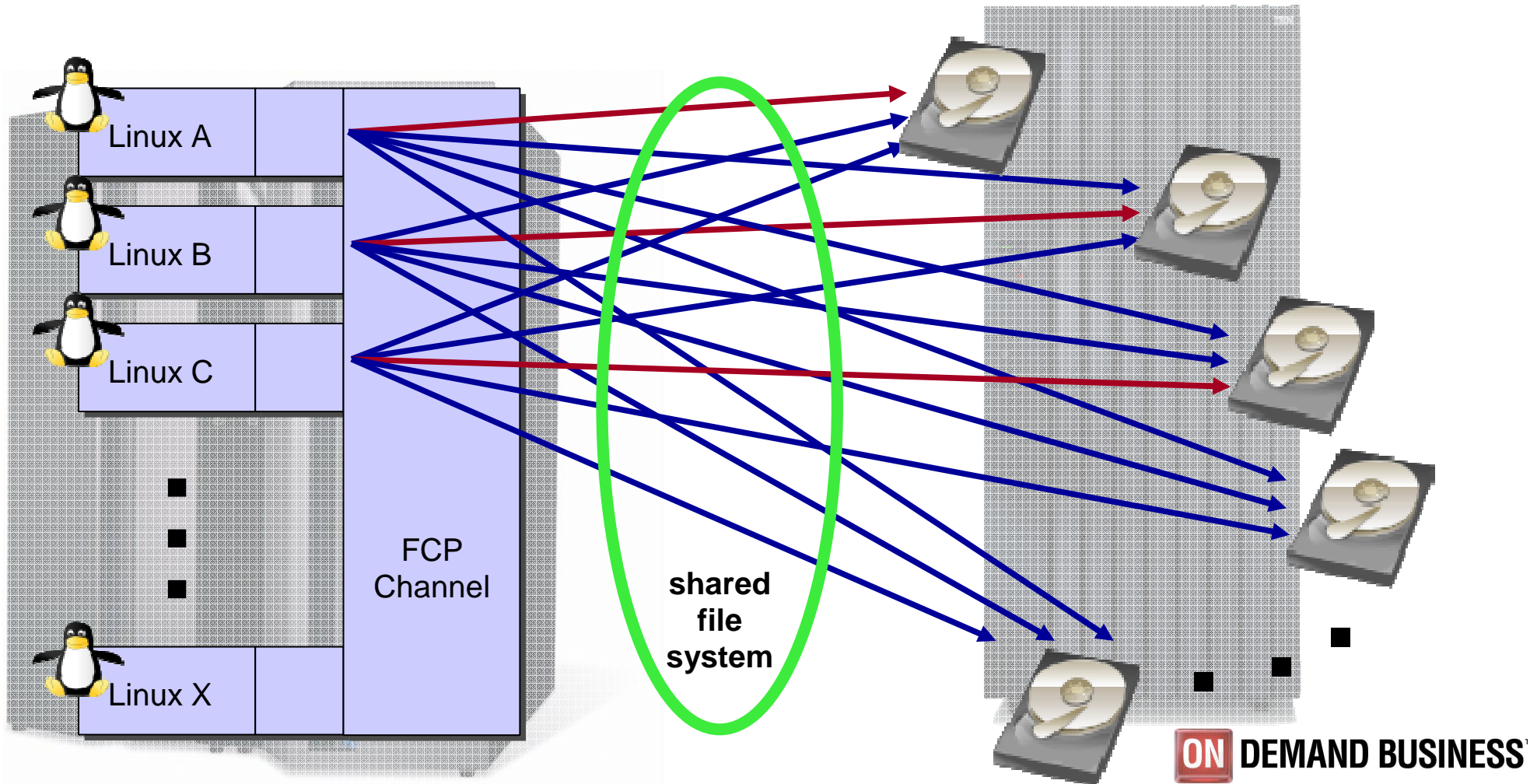


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New Possibilities

'Exclusive LUN' policy eliminated

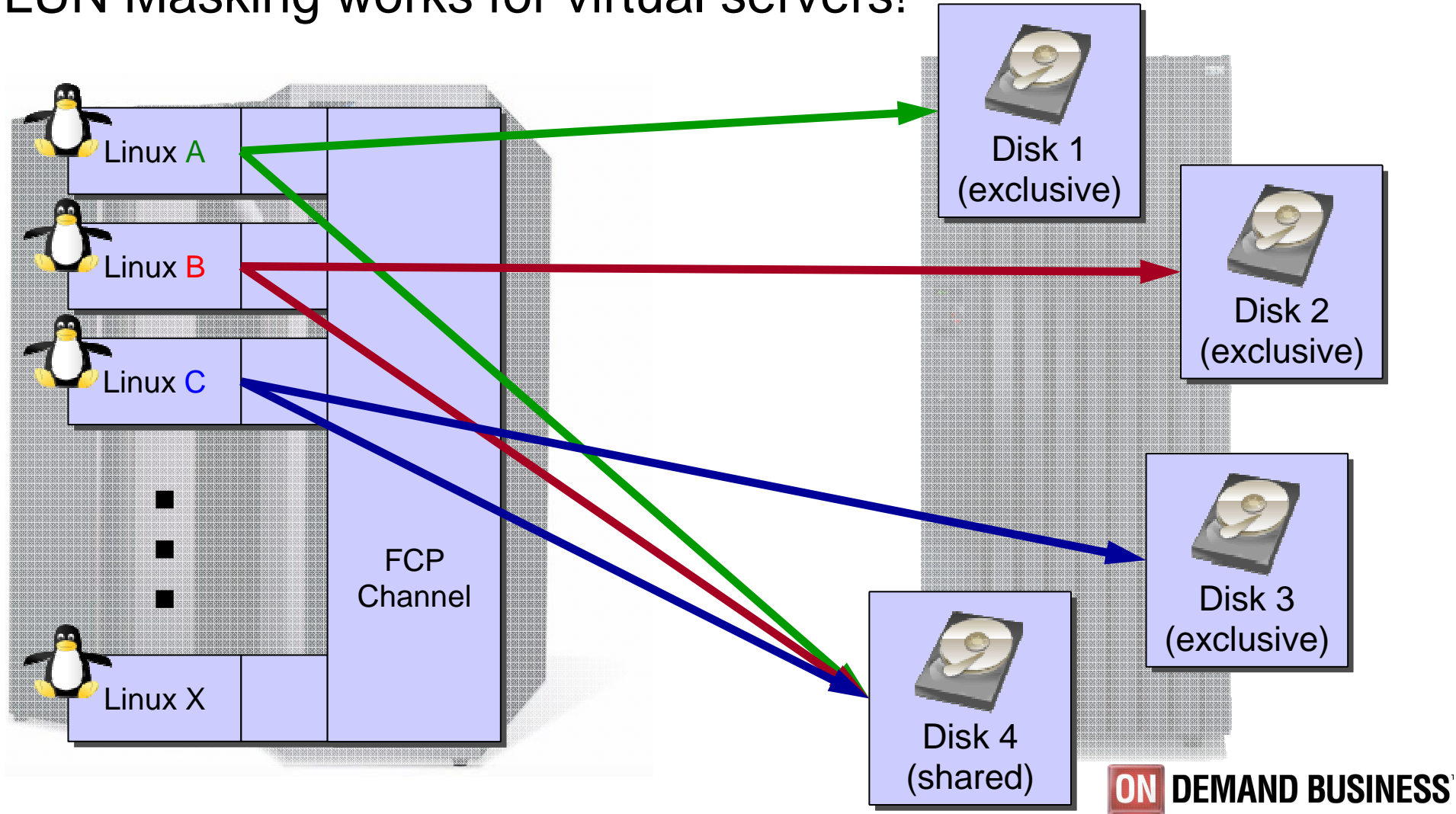
- o Shared SAN file systems



New Possibilities

Access Control Done Right

- o LUN Masking works for virtual servers!

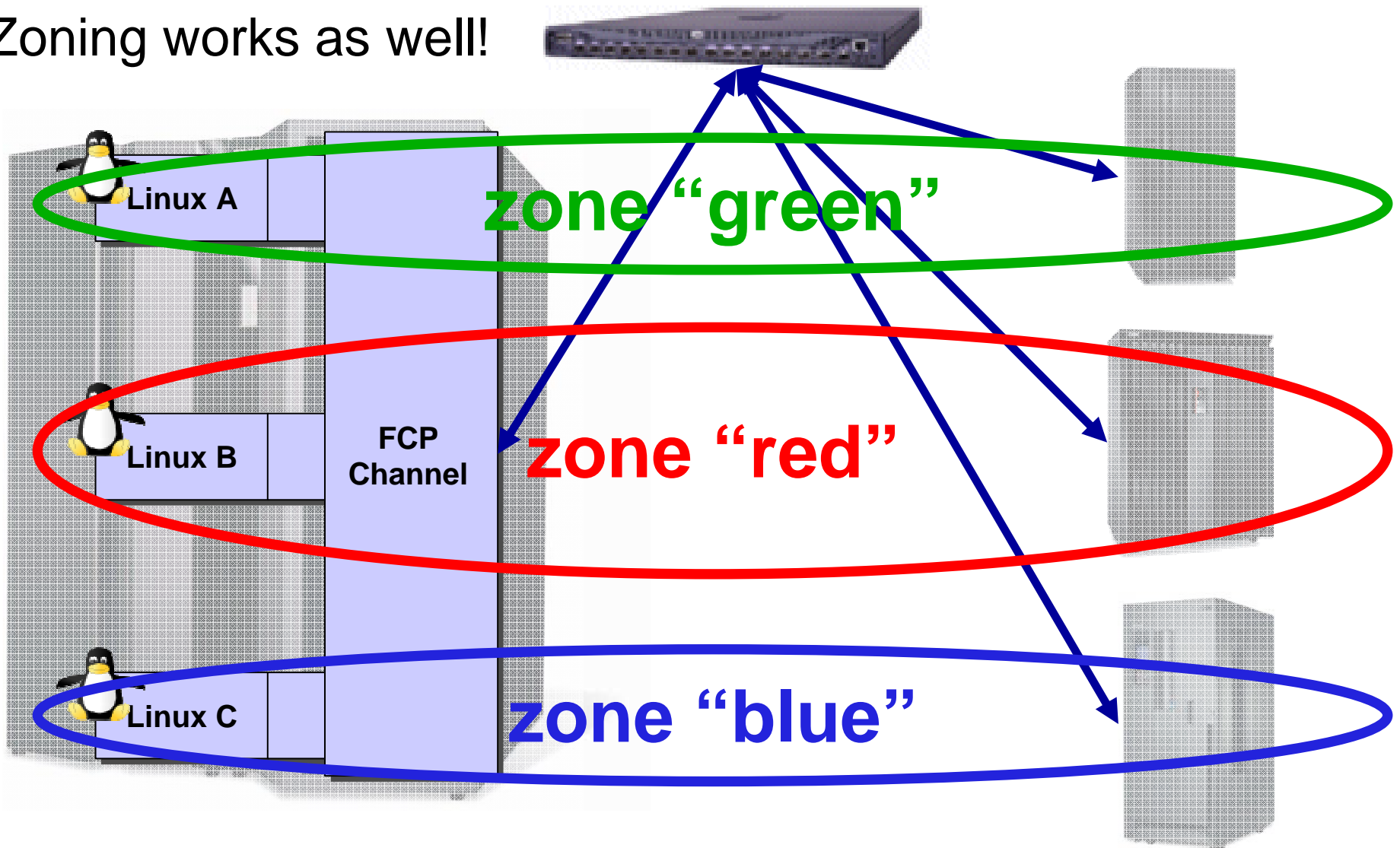


ON DEMAND BUSINESS

New Possibilities

Access Control Done Right

- o Zoning works as well!



New Possibilities

Access Control Feature

- NPIV deprecates the FCP Channel Access Control feature
- Access Control feature still available with System z9, (could be used for subchannels operating in backward-compatible non-NPIV mode)
- ACT rules – if defined – are not applied to FCP subchannels in NPIV mode



Requirements



- NPIV is available on System z9 servers.
 - FICON Express 2 adapter running with MCL003 on EC J99658
- z/VM
 - z/VM 5.2
 - z/VM 5.1 with the PTF for APAR VM63744
- Linux Distribution
 - Currently SLES9 SP3 and SLES10 (LPAR mode or z/VM)
- NPIV-Capable Switch
 - only required for switch adjacent to z9
 - Mostly firmware upgrades possible (e.g. McData, Brocade)

Linux Support

Almost Dispensable

- NPIV is more or less transparent for operating systems
 - Linux uses the new virtual N-Port in the same way as it has used non-virtual N-Ports
- But: some new error codes/messages defined for NPIV-type subchannels (e.g. if you run out of D_IDs)
- Linux code shipped with SLES9 SP3 and SLES10

see
also

Introducing N_Port Identifier Virtualization for IBM System z9

<http://www.redbooks.ibm.com/redpapers/pdfs/redp4125.pdf>

see
also

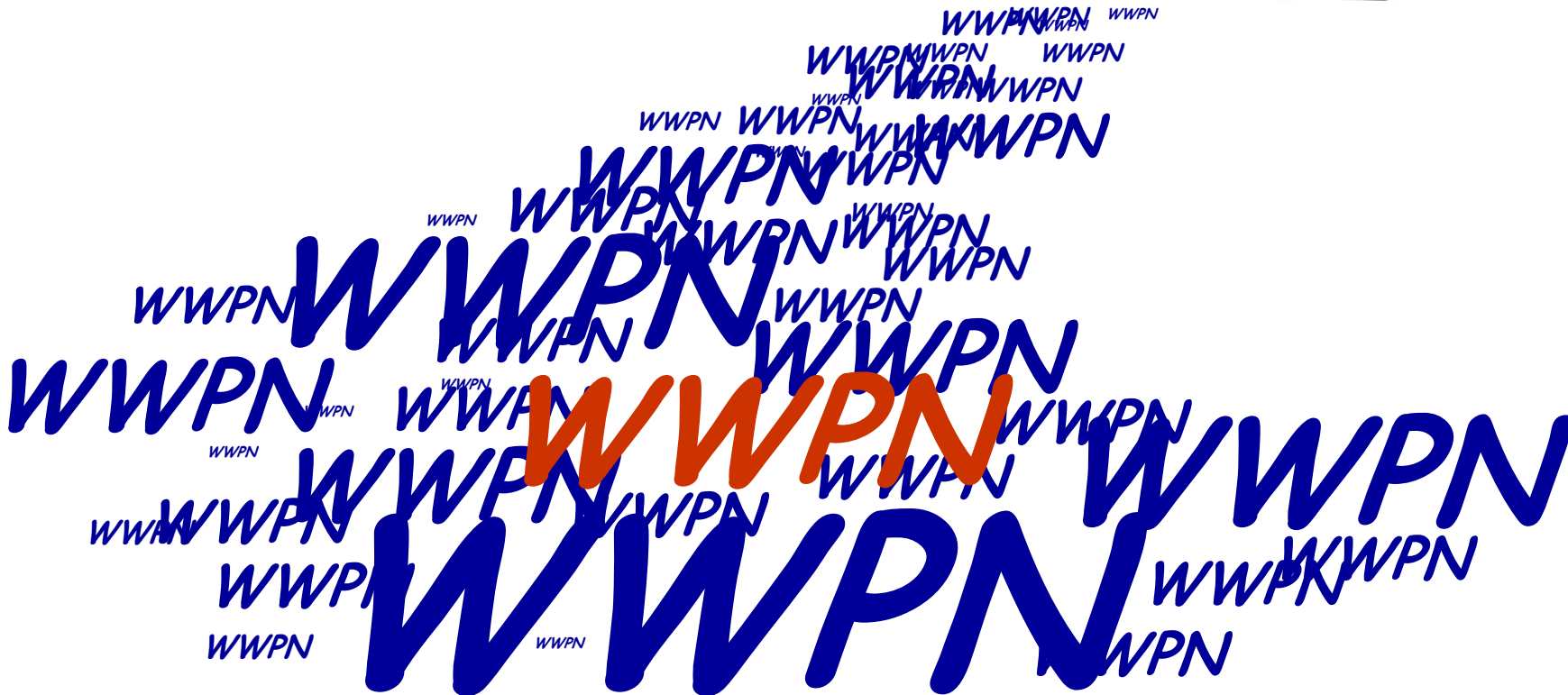
Linux on zSeries

<http://www.ibm.com/developerworks/linux/linux390/index.html>

Getting Started

“Floods” of WWPNs

- Many new WWPNs to be used by zoning and LUN masking/mapping functions
- Can be exported from SE through FTP



Getting Started

- 1) Pre-plan SAN with NPIV support
 - see practical limits of components
- 2) Define FCP subchannels in IOCDS
 - prior to IML, or
 - using dynamic I/O (HCD/HCM)
- 3) Perform IML, if needed
 - WWPNs for new subchannels get assigned
- 4) Query WWPNs using SE/HMC panel
 - needed for configuration of SAN functions
 - export function through FTP available



NPIV Step-by-Step

Getting Started

- 5) Configure switch adjacent to z9
 - ensure NPIV is enabled
 - ensure enough virtual N-Ports per port
 - setup zoning for virtual N-Ports
- 6) Configure target device
 - setup LUN masking/mapping
- 7) Enable NPIV-mode for CHPID in LPAR
 - CHPID must be temporarily toggled off
- 8) Start using FCP subchannel in Linux
 - check for NPIV related error messages



NPIV Step-by-Step (cont.)

Getting Started

Implementation Limits

- Switches will presumably allow for 1024 or up to 8192 WWPNs in a SAN
- Storage device impose limits as well
- Theoretically up to 255 subchannels per channel connected at the same time
- ≤ 510 active target port connections for all subchannels of a channel
- Each System z9 provides a total of 2 million WWPNs for virtual HBAs

see
also

Support of Fiber Channel Protocol for SCSI - FCP channels

<http://www-03.ibm.com/systems/z/connectivity/fcp.html>

Hints and Tips

- Do not use more than 32 subchannels per physical channel in NPIV mode.
- Zone each NPIV WWPN individually. This can reduce fabric traffic.
- Consider using multipathing (performance and availability).
- Enable NPIV on the SAN switch before enabling it on the System z9 server.
- Be aware that each login from a NPIV-mode subchannel into a storage subsystem counts as a separate host login. There are limits at storage side.
- Switches typically limit the number of supported N_Port IDs.
- Some switches limit the number of N_Port IDs that can be assigned to a physical port.
- FCP microcode MCL003 on EC J99658 requires a special activation procedure. All FCP PCHIDs should be configured off *before* activating the MCL.

Look'n Feel

NPIV Is On

The screenshot shows the T29 Primary Support Element Workplace (Version 2.9.0) interface. A menu is open, highlighting 'CHPID Operations'. A dialog box titled 'T29: NPIV Mode On/Off - Mozilla' is displayed, showing the following table:

Partition	CSS	CHPID	NPIV Mode Enabled
T29LP19	1	3d	<input checked="" type="checkbox"/>

Buttons: Select All, Deselect All, Apply, Cancel, Help

- o Your choice:
toggle NPIV on with a per channel-and-LPAR granularity
(CHPID needs to be toggled off temporarily)

Look'n Feel

You won't run out of WWPNs, but if ...

The screenshot shows the T29 Primary Support Element Workplace (Version 2.9.0) interface. On the left, a navigation tree is visible with 'CPC Configuration' selected. A context menu is open over the 'CPC Configuration' item, listing various actions. The 'Display NPIV Configuration' option is highlighted. In the foreground, a dialog box titled 'FCP Channel - FCP NPIV Port Names' is displayed. The dialog contains instructions and three buttons: 'Display Assigned Port Names...', 'Release All Locked Port Names', and 'Release Subset Of Locked Port Names...'. A red oval highlights the 'Release Subset Of Locked Port Names...' button.



Look'n Feel

List Of Virtual N-Ports

T29: Display Assigned Port Names - Mozilla

Partition	CSS	IID	CHPID	SSID	Device Number	WWPN	IOCCS	NPIV Mode
T29LP46	03	01	3d	00	5200	c05076ffe803514	A0 A1	On
T29LP46	03	01	3d	00	52fc	c05076ffe803518	A0 A1	On
T29LP46	03	01	3d	00	52fd	c05076ffe80351c	A0 A1	On
T29LP46	03	01	55	00	1700	c05076ffe8029dc	A0 A1	On
T29LP19	01	04	3d	00	5203	c05076ffe8031dc	A0 A1	On
T29LP19	01	04	3d	00	52fc	c05076ffe8031e0	A0 A1	On
T29LP19	01	04	3d	00	52fd	c05076ffe8031e4	A0 A1	On
T29LP08	00	08	3d	00	5207	c05076ffe803054	A0 A1	On
T29LP08	00	08	3d	00	52fc	c05076ffe803058	A0 A1	On
T29LP08	00	08	3d	00	52fd	c05076ffe80305c	A0 A1	On
T29LP08	00	08	55	00	1707	c05076ffe802644	A0 A1	On
T29LP30	01	0f	3d	00	521d	c05076ffe803288	A0 A1	On

Buttons: Transfer via FTP, Cancel, Help, Show all, Show NPIV=On

- Hardware Messages
- Operating System Messages
- Perform Model Conversion
- Edit Frame Layout
- System (Sysplex) Time
- Input/output (I/O) Configuration
- View Hardware Configuration
- Rebuild Vital Product Data
- Nondisruptive Hardware Change
- MSQ Processor Test
- Update HOM and VPD
- View CBU Feature Information
- Channel PCHID Assignment
- Update Hardware LICCC
- Cryptographic Configuration
- Cryptographic Management
- Display NPIV Configuration**
- Transmit Vital Product Data
- View On/Off CoD Feature Information

- CPC Remote Customization
- CPC Operational Customization
- CPC Configuration**
- CP Toolbox
- CHPID Operations
- Channel Operations
- Crypto Service Operations



Look'n Feel

Linux Proudly Presents: Its Own SAN Identity

virtual N-Port tied to this FCP
subchannel

in non-NPIV mode:

same WWPN

in NPIV mode:

WWPNs differ

physical N-Port tied to FCP
channel (CHPID)

```
# pwd
/sys/class/fc_host/host0
```

```
# cat node_name
0x5005076400cd6aad
# cat port_name
0x5005076401008fa8
# cat permanent_port_name
0x5005076401008fa8
```

(WWNN - Host)
(WWPN - virtual Adapter)
(WWPN - physical Adapter)

```
# cat node_name
0x5005076400cd6aad
# cat port_name
0xc05076fffe8031dc
# cat permanent_port_name
0x5005076401008fa8
```

SLES10

Keep in Mind

NPIV is NOT about ...

- ... reducing SAN maintenance work
 - but it straightens out the way of doing things
- ... migrating virtual servers more easily
 - but it enables virtual servers in FC SANs
- ... introducing new FC security schemes
 - but it integrates virtual servers into existing ones
- ... solving any SAN issue immediately
 - but it provides a foundation to build on



Summary

„Ready, steady, ... go!“

- NPIV removes the root cause for limited practicability of FCP in virtual server environments
- NPIV allows the use of standard SAN management solutions on IBM System z9
- NPIV gives free rein to sophisticated SAN fantasies

NPIV

FCP Channel Virtualization in a Linux Environment

Questions ?



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