

Em09. **2020 - The Year We Make Contact**

Let Domino control your building

Thomas Bahn, March 3rd, 2020

Engage 2020, Arnhem, The Netherlands



Thomas Bahn

- Computer enthusiastic for 35 years
- Graduate mathematician
- Consultant and managing director for an IT service provider in Germany

Agenda



- Motivation: Smart Home, Smart Office, Smart Building, Smart Everything?
- Automate your building with KNX
- The glue: ioBroker and Node-RED
- Demo and examples
- Secret Bonus 😊

Motivation

Smart Home,
Smart Office,
Smart Building,
Smart Everything?



- see the first three minutes of:
The Big Bang Theory, Season 1, Episode 9: “The Cooper-Hofstadter Polarization”

Why?

- Because we can 😁
- Energy savings
- Improve comfort
- Increase security
- Flexibility and personalization
- Automate tasks

Why integrate building automation with Domino?



- Once more: Because we can 😊
- Domino “knows” about people, organizations, rooms, meetings, ...
- With this integration Domino can ...
 - react to events (e.g. movement, smoke) and states (e.g. heating is on)
 - control devices (e.g. lighting)
 - store data about the building(s), devices, events and states
 - get information through APIs from other systems (e.g. weather forecast) and use it to automate the building

- Domino knows about the meeting and the current weather conditions.
It can regulate heating or cooling and control the shading and ventilation in the room on time and only when necessary. Never start your day again freezing in a meeting room.
- Let a Notes client, Domino Web application or even a RESTful Web service control lighting, blinds, heating, cooling, ventilation, etc. Control your building even from afar.
- Send emails, text messages, or even Sametime broadcasts when sensors detect something unusual or important in your building, and log everything to a database.
- Restart the Domino tasks by pushing a real (hardware) button. 😊

Automate your
building with
KNX



- „**KNX** is an open standard (see EN 50090, ISO/IEC 14543) for commercial and domestic building automation. KNX devices can manage lighting, blinds and shutters, HVAC, security systems, energy management, audio video, white goods, displays, remote control, etc.“

[https://en.wikipedia.org/wiki/KNX_\(standard\)](https://en.wikipedia.org/wiki/KNX_(standard))

- HVAC: heating, ventilation and air conditioning



Smart home and building solutions.
Global. Secure. Connected.

- “A benefit in every type of building: From the office complex to the average household. [...]
- KNX opens up complete new opportunities for building control systems [...]
- Via a single touch panel, all applications in the home or building can be controlled. [...]
- KNX allows completely new ways of increasing comfort, safety and energy savings in a home or building.”

- “References all over the world: [...] Several million successful KNX installations [...]
- International Standard (ISO/IEC 14543-3) as well as a European Standard (CENELEC EN 50090 and CEN EN 13321-1) and Chinese Standard (GB/T 20965). [...]
- KNX products made by different manufacturers can be combined – the KNX trademark logo guarantees their interworking and interoperability [...]
- 490 KNX manufactures in 45 countries
- 8,000 KNX certified products
- over 82,000 KNX partners in 190 countries
- 21 KNX user club/professionals in 19 countries

- „KNX provides the possibility to secure its communication through authentication and/or encryption, based on the internationally standardized AES 128 algorithms.“

- „Since over 10 years, KNX installations can be seamlessly coupled to IP networks through the KNXnet/IP protocol. Hundreds of solutions already exist in the market to make this possible: through the KNX IoT project, KNX hopes to further standardize these solutions. “

- Lighting,
- Blinds/shutters,
- Security systems,
- Energy management,
- Metering,
- Remote control,
- Audio/video control,
- White goods,
- Heating,
- Ventilation and
- Air-conditioning systems,
- Signaling and monitoring systems,
- Interfaces to service and building control systems,
- etc.

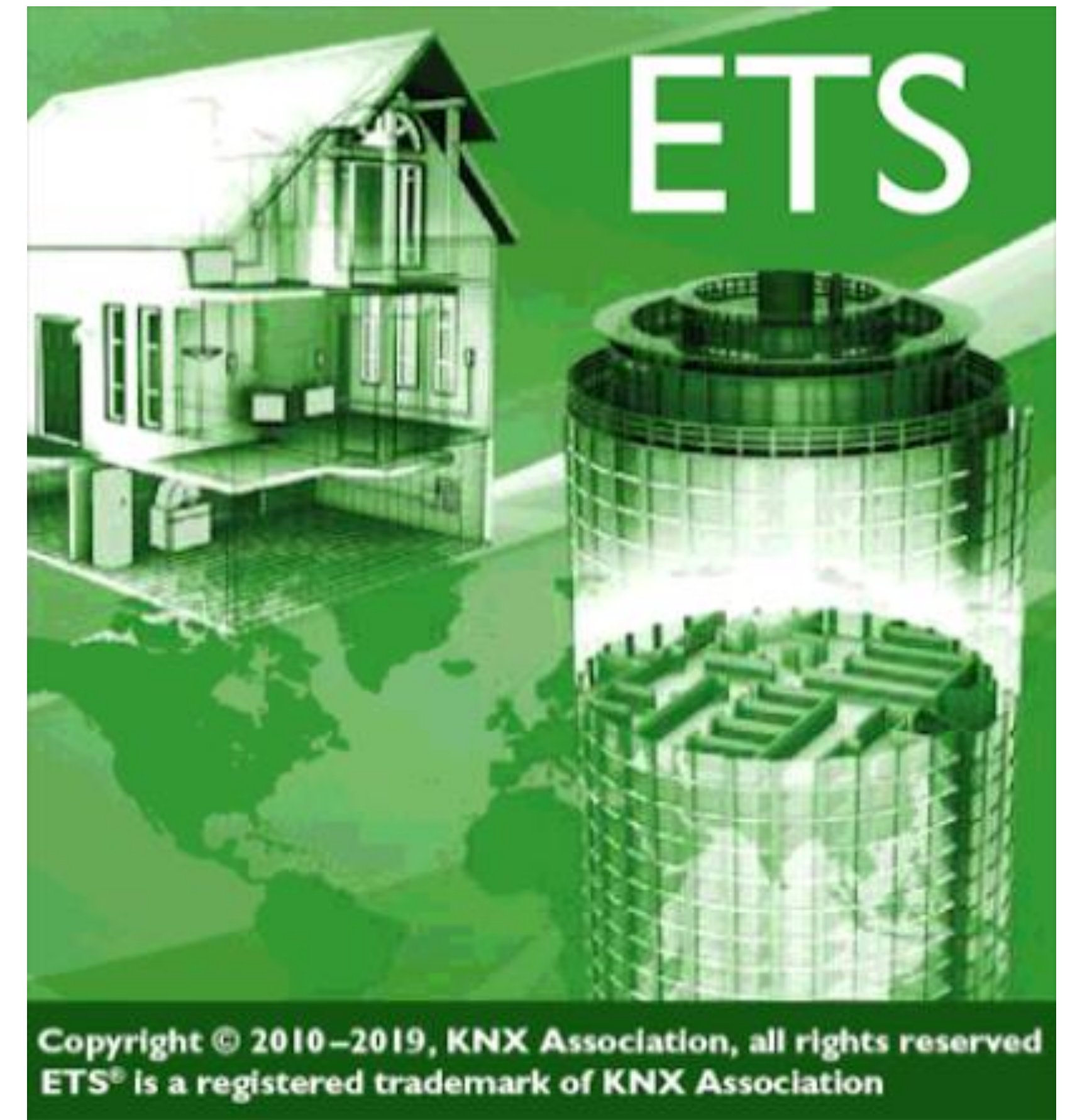
- Twisted pair,
- Radio frequency,
- Power line or
- IP/Ethernet-WIFI

- Cable bound (twisted pair) devices are in a line = bus/ring topology
- Lines can be connected in a lot of different ways, e.g. star topology
- Most often (probably):
 - a line per floor
 - all lines are interconnected centrally in building
 - buildings can be interconnected, too (using IP)
- Power line can be used to connect distant, isolated devices.
- RF can be used, when cables are unfeasable.

- Switches and buttons
- Motion detectors
- Open/closed or locked/unlocked sensors
- Binary inputs to connected “unconnected” devices
- Weather station
- Thermometers (e.g. in heating thermostats)
- Security systems

- Switching actuators for:
 - Lighting (lamps)
 - Power sockets
 - Binary outputs to connected “unconnected” devices
- Dimming actuators
- Heating thermostats
- Blinds and shutters
- Sirens

- Engineering Tool Software (ETS) for
 - Managing physical devices
 - Initializing new devices
 - Programming devices
 - Monitoring and debugging



- Each connected devices has a physical address
- Used for addressing the device e.g. for programming it

Geräte ▾

 Geräte hinzufügen |  Löschen  Programmieren |  Geräteinfo  Zurücksetzen  Entladen  Drucken

uche

[illegible]

- Group addresses used to send messages
- A device can listen to many group addresses
- Devices can send one group address per event (like button press)

Gruppenadressen ▾

 Gruppenadressen hinzufügen | ▾
  Löschen
  Programmieren | ▾
  Geräteinfo ▾
  Zurücksetzen
  Entladen ▾
  Drucken

Gruppenadressen ▾

	Adresse ^	Name	Beschreibung	Zentra	Durch	Datentyp
▸  Dynamische Ordner	 2/3/0	L-D1 E/A Bibliothek, 3x Decke		Nein	Nein	Schalten
▸  1 Zentralfunktionen	 2/3/3	L-D1 RM E/A Bibliothek, 3x Decke		Nein	Nein	Schalten
▾  2 Licht	 2/3/5	L-D2 E/A Ankleide, 3x Decke		Nein	Nein	Schalten
▸  2/0 Licht zentral/Szenen	 2/3/8	L-D2 RM E/A Ankleide, 3x Decke		Nein	Nein	Schalten
▸  2/1 Licht KG	 2/3/10	L-D3a E/A Bad, 1x Wand, Einbauspiegelschrank		Nein	Nein	Schalten
▸  2/2 Licht EG	 2/3/13	L-D3a RM E/A Bad, 1x Wand, Einbauspiegelschrank		Nein	Nein	Schalten
▾  2/3 Licht DG	 2/3/15	L-D3b E/A Bad, 3x Decke		Nein	Nein	Schalten
 2/3/18 L-D3b RM E/A Bad, 3x D...	 2/3/18	L-D3b RM E/A Bad, 3x Decke		Nein	Nein	Schalten
 2/3/0 L-D1 E/A Bibliothek, 3x De...	 2/3/20	LD-D4 E/A Schlafen, 3x Decke		Nein	Nein	Schalten
 2/3/3 L-D1 RM E/A Bibliothek, 3...	 2/3/21	LD-D4 DIM Schlafen, 3x Decke		Nein	Nein	Dimmer Schritt
 2/3/5 L-D2 E/A Ankleide, 3x Dec...	 2/3/22	LD-D4 WERT Schlafen, 3x Decke		Nein	Nein	Prozent (0..100%)
 2/3/8 L-D2 RM E/A Ankleide, 3x...	 2/3/23	LD-D4 RM E/A Schlafen, 3x Decke		Nein	Nein	Schalten
 2/3/10 L-D3a E/A Bad, 1x Wand,...	 2/3/24	LD-D4 RM WERT Schlafen, 3x Decke		Nein	Nein	Prozent (0..100%)
 2/3/13 L-D3a RM E/A Bad, 1x W...	 2/3/25	L-D5a E/A Flur DG, 5x Decke, vor Einbausschrank & über der "Brücke"		Nein	Nein	Schalten
 2/3/15 L-D3b E/A Bad, 3x Decke	 2/3/28	L-D5a RM E/A Flur DG, 5x Decke, vor Einbausschrank & über der "Brücke"		Nein	Nein	Schalten
 2/3/18 L-D3b RM E/A Bad, 3x D...	 2/3/30	L-D5b E/A Flur DG, 6x Decke, Strahler über Galerie		Nein	Nein	Schalten
	 2/3/33	L-D5b RM E/A Flur DG, 6x Decke, Strahler über Galerie		Nein	Nein	Schalten
	 2/3/35	L-D5c E/A Flur DG, 1x Decke, Deckenleuchter über Galerie		Nein	Nein	Schalten

- A message is sent
 - from a device
 - to a group address
 - with a value
 - of a type (DPT)

Diagnose ▾



Start



Stop



Löschen



Öffnen



Speichern



Drucken



Telegramme wiedergeben



Optionen



Gruppenfunktionen

Suchen

Gruppenmonitor

Gruppenadresse

Datenpunktyp

1.001 Schalten ▾

Verzögerung[sec]

0



Letzter empfangener Wert

Wert

Aus ▾

Zyklisch senden

☐

# ^	Zeit	Dienst	Flags	Prio	Quelladresse	Quellname	Zieladresse	Zielname	Rout	Typ	DPT	Info
1	02.03.2020 09:43:50,8...	vom Bus		Niedrig	1.1.60	S-K5 2/4+RTR	4/1/51	HK-K5 IST Heizkreis Gast KG	5	GroupValueW...	9.001 Tem...	07 C1 19,85 °C
2	02.03.2020 09:43:51,0...	vom Bus		Niedrig	1.3.20	S-D2 2/4+RTR	4/3/24	HK-D2 RM SOLL Heizkreis Anklei...	5	GroupValueW...	9.001 Tem...	07 D0 20 °C
3	02.03.2020 09:43:51,0...	vom Bus		Niedrig	1.3.20	S-D2 2/4+RTR	4/3/22	HK-D2 SOLL Heizkreis Ankleide...	5	GroupValueW...	9.001 Tem...	07 D0 20 °C
4	02.03.2020 09:43:52,6...	vom Bus		Niedrig	1.2.10	S-E1a 2/4+RTR Tür zur Garage	4/2/11	HK-E1 IST Heizkreis Vorküche EG	5	GroupValueW...	9.001 Tem...	07 8E 19,34 °C
5	02.03.2020 09:43:54,...	vom Bus		Niedrig	1.3.30	S-D3a 2/4+RTR oben	4/3/31	HK-D3 IST Heizkreis Bad DG	5	GroupValueW...	9.001 Tem...	0C A6 23,8 °C
6	02.03.2020 09:43:54,...	vom Bus		Niedrig	1.2.46	S-E4g 2/4+RTR neben Terrassent...	4/2/41	HK-E4 IST Heizkreis Wohnen EG	5	GroupValueW...	9.001 Tem...	0C 95 23,46 °C
7	02.03.2020 09:43:54,...	vom Bus		Niedrig	1.2.51	S-E5b 2/4+RTR zwischen Gäste-...	4/2/51	HK-E5 IST Heizkreis Flur EG	5	GroupValueW...	9.001 Tem...	0C A9 23,86 °C
8	02.03.2020 09:43:55,8...	vom Bus		Niedrig	1.1.30	S-K2 2/4+RTR	4/1/21	HK-K2 IST Heizkreis WC KG	5	GroupValueW...	9.001 Tem...	07 77 19,11 °C
9	02.03.2020 09:43:56,1...	vom Bus		Niedrig	1.1.80	S-K7 2/4+RTR	4/1/71	HK-K7 IST Heizkreis Wäsche KG	5	GroupValueW...	9.001 Tem...	0C 01 20,5 °C
10	02.03.2020 09:43:57,1...	vom Bus		Niedrig	1.3.11	S-D1b 2/4+RTR neben Tür zum Fl...	4/3/11	HK-D1 IST Heizkreis Bibliothek DG	5	GroupValueW...	9.001 Tem...	0C 9C 23,6 °C
11	02.03.2020 09:43:59,...	vom Bus		Niedrig	1.2.10	S-E1a 2/4+RTR Tür zur Garage	4/2/10	HK-E1 E/A Heizkreis Vorküche EG	5	GroupValueW...		\$00 Aus
12	02.03.2020 09:43:59,9...	vom Bus		Niedrig	1.1.70	S-K6a 2/4+RTR neben Tür zur Sa...	4/1/61	HK-K6 IST Heizkreis Flur KG	5	GroupValueW...	9.001 Tem...	07 D9 20,09 °C
13	02.03.2020 09:44:01,4...	vom Bus		Niedrig	1.1.40	S-K3 2/4+RTR	4/1/31	HK-K3 IST Heizkreis Abstellen KG	5	GroupValueW...	9.001 Tem...	06 FA 17,86 °C
14	02.03.2020 09:44:03,...	vom Bus		Niedrig	1.3.20	S-D2 2/4+RTR	4/3/21	HK-D2 IST Heizkreis Ankleide DG	5	GroupValueW...	9.001 Tem...	0C 75 22,82 °C
15	02.03.2020 09:44:04,...	vom Bus		Niedrig	1.1.21	S-K1b 2/4+RTR neben Tür zum Fl...	4/1/11	HK-K1 IST Heizkreis Sauna KG	5	GroupValueW...	9.001 Tem...	07 E5 20,21 °C

Domino Server and Applications



- Typically, the Domino infrastructure and the application for the processes already exist.
- Is used via Notes client or Web browser.
- From internal users and potentially some external ones.



Connecting Domino and KNX?

- KNX IoT: Web Service Gateway
- KNX IP Gateway plus
 - DIY with Falcon libraries
 - Falcon 2.2 (2015!): COM based library, deprecated
 - Falcon.NET SDK (current): Microsoft .net based library
 - Platforms with ready-to-use KNX adapters
 - e.g. OpenHAB, ioBroker (both Open Source), ...



Connecting Domino and KNX through ioBroker



ioBroker

- “ioBroker is an IoT platform (Fog computing).”, <https://www.iobroker.net/#en/intro>
- Building automation on premises (with an optional cloud component)
- Runs on Windows, Linux, OSX, Raspberry Pi or ARM
- Written in JavaScript, based on Node.js
- Open Source (you only pay, if you use the cloud component)
- Lots of adapters for devices, services and systems (nearly all are Open Source as well)
- One of them: KNX (dual licensing)



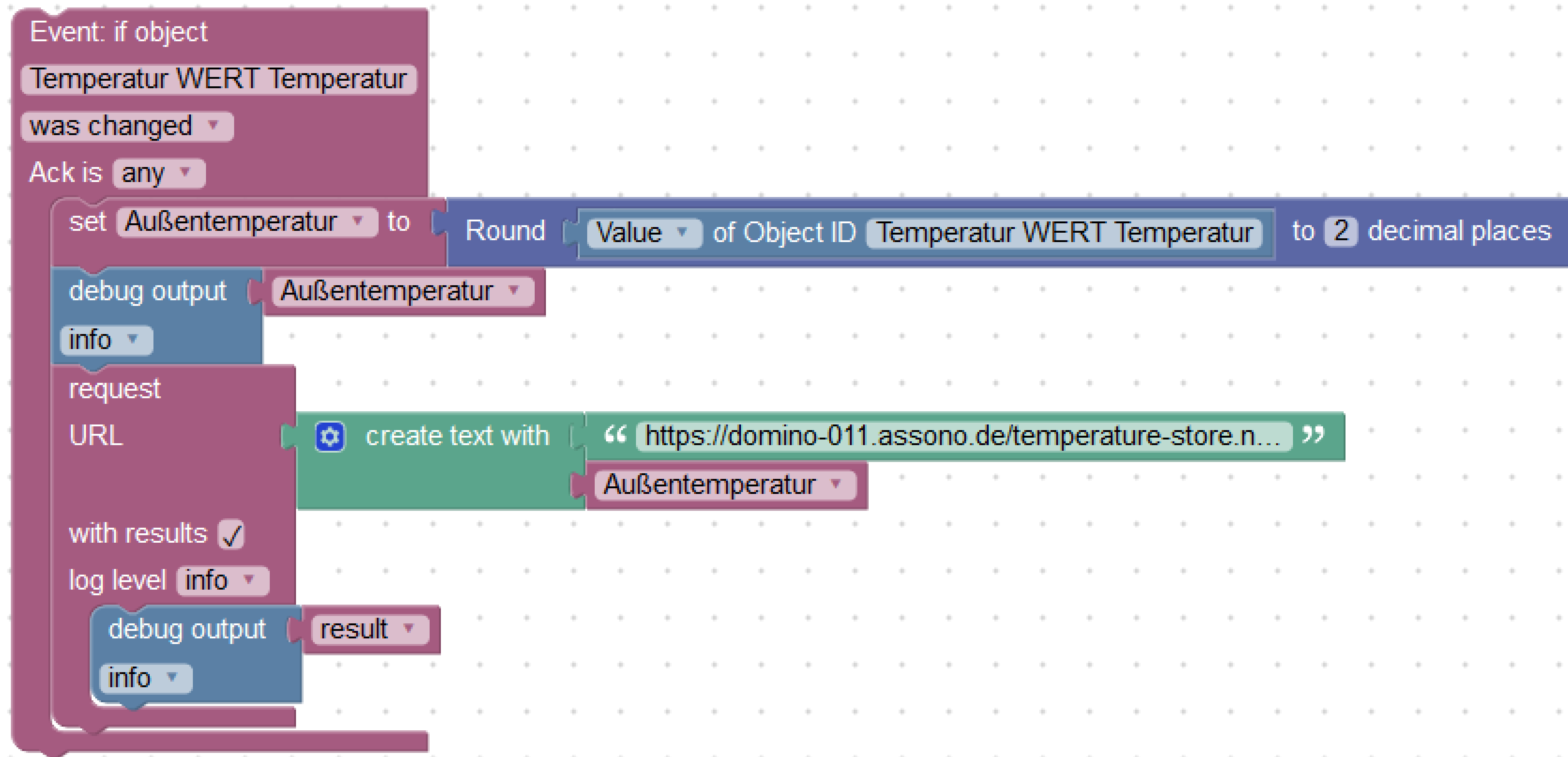
Timestamp	Outside Temperature
2020-03-02 11:58:26	11,0
2020-03-02 11:53:26	11,0
2020-03-02 11:48:26	11,0
2020-03-02 11:43:25	11,0
2020-03-02 11:38:25	11,0
2020-03-02 11:33:25	11,0
2020-03-02 11:28:25	11,0
2020-03-02 11:23:25	11,0
2020-03-02 11:18:25	11,0
2020-03-02 11:13:25	11,0
2020-03-02 11:08:25	11,0
2020-03-02 11:03:25	10,0
2020-03-02 10:58:25	10,0
2020-03-02 10:55:10	11,0

Demo

Domino stores temperature data

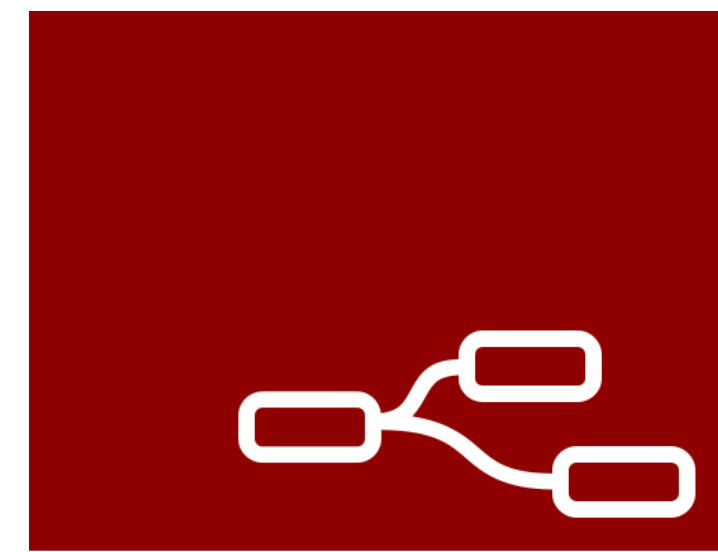
- Weather station sends temperature to KNX
- Blockly script registers for this events
- Sends data and uses CreateDocument-URL to create new document in Domino database

Engage 2020-Demo		
 Measurements Temperature Measurements Lamp Control Hilfen Administration	Timestamp	Outside Temperature
	2020-03-05 00:23:11	6.0
	2020-03-05 00:18:11	6.0
	2020-03-05 00:13:12	6.0
	2020-03-05 00:08:12	5.0
	2020-03-05 00:03:12	6.0
	2020-03-04 23:58:11	6.0
	2020-03-04 23:53:11	5.0
	2020-03-04 23:48:11	5.0
	2020-03-04 23:43:11	5.0



- Form alias: TemperatureMeasurement
- Form property: Formulas inherit values from selected document
- Fields:

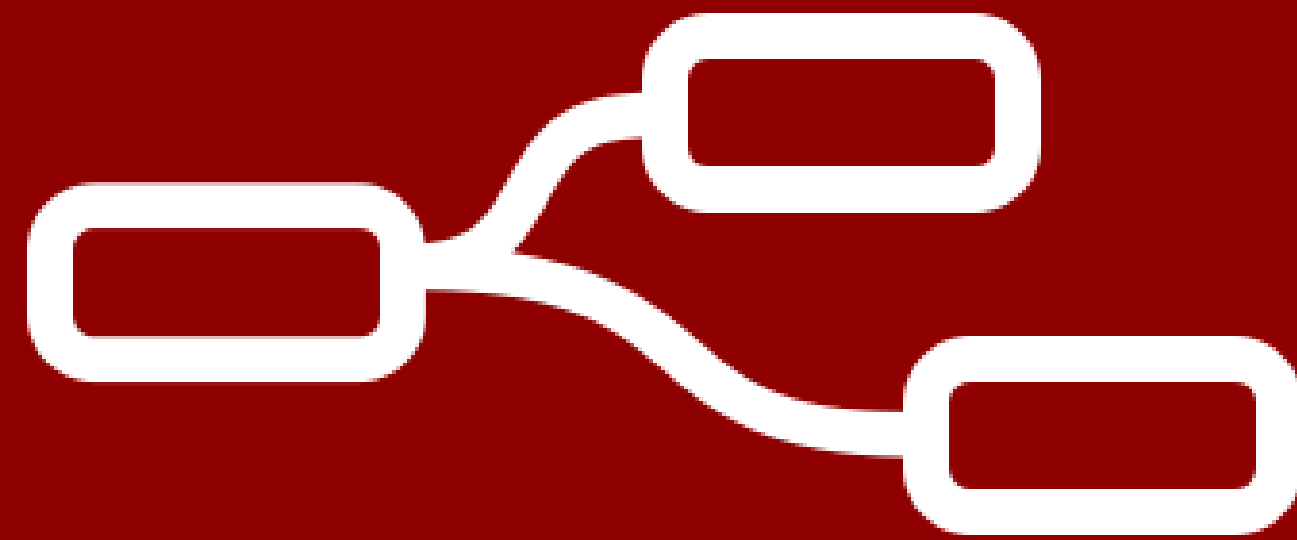
OutsideTemp (String)	OutsideTemp T	@ReplaceSubstring(@Left(@UrlQueryString(@ThisName); 7); ":", ".")
OutsideTemp	OutsideTempNumber # °C	@TextToNumber(@ReplaceSubstring(OutsideTemp; ":", "."))
Timestamp	Timestamp 16	@Now



Node-RED



Connecting Domino and KNX through Node-RED



Node-RED

Node-RED

- Web application based on Node.js
- Flow based programming: data flows through a network of nodes
- Stems from IBM IoT team members, Open Source
- Huge library of nodes and flows available
- Create a Node-RED instance in ioBroker



Lamp is off

Demo

Let Domino switch the lights

- Domino sends HTTP request using LotusHttpRequest
- ioBroker receives request in Node-RED flow and creates KNX command
- KNX command is broadcasted and actuator reacts by switching on the light

Public Sub Initialize
 Call GetLampState()
End Sub

Engage 2020-Demo



Measurements
 Temperature Measurements

Lamp Control → @Command([ToolsRunMacro]; "(OpenLampControl)")

Lamp Control form



Form	Form T	"LampControl"
LampState	LampState T	LampState
SaveOptions	SaveOptions T	"0"



```
Sub Click(Source As Button)
  Print "Click on Lightbulb on"
  Call SetLampState( "on")
End Sub
```



```
Sub Click(Source As Button)
  Print "Click on Lightbulb off"
  Call SetLampState( "off")
End Sub
```

<Computed Value>
Value: LampState

Option Public

Option Declare

Use "Common Notes UI utils"

Use "Logging utils"

Private serviceBaseURL As String

Sub Initialize

 serviceBaseURL = GetDBProfileDoc().GetItemValue("LampServiceBaseURL")(0)

End Sub

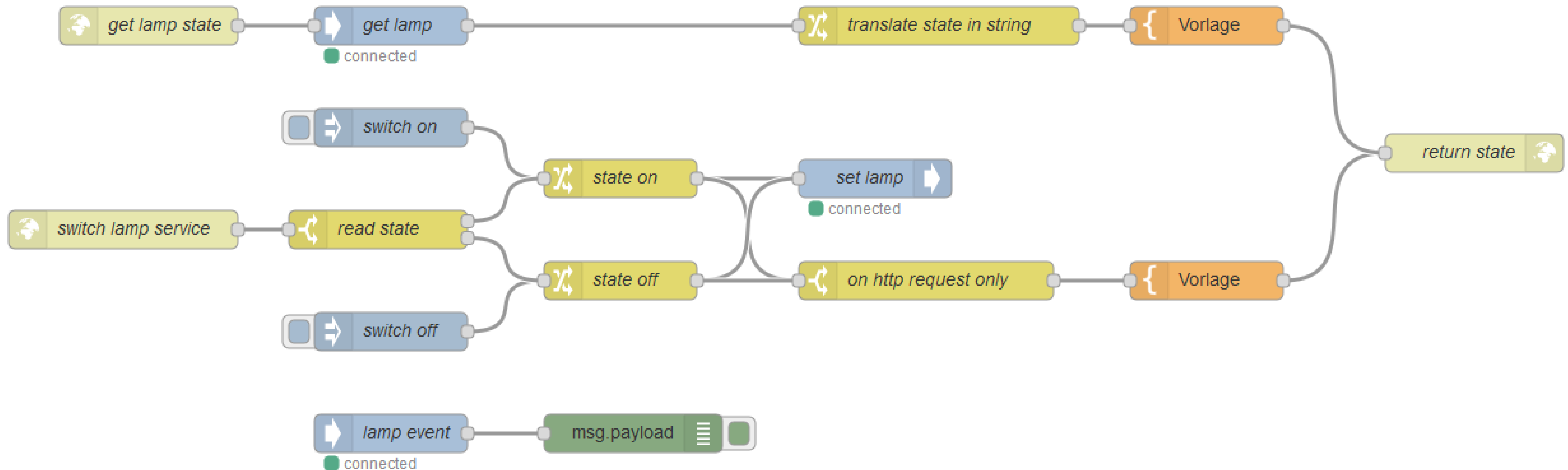
```
Public Sub GetLampState()  
    Dim req As NotesHTTPRequest  
    [...]  
  
    Set req = session.CreateHTTPRequest()  
    res = req.Get(serviceBaseURL & "/lamp-state")  
  
    Set doc = currentDB.CreateDocument()  
    Call doc.ReplaceItemValue("Form", "LampControl")  
    Call doc.ReplaceItemValue("LampState", res)  
    Set uidoc = uiws.EditDocument(True, doc)  
End Sub
```

```
Public Sub SetLampState(newState As String)
    Dim req As NotesHTTPRequest
    [...]

    Set req = session.CreateHTTPRequest()
    res = req.Get(serviceBaseURL & "/lamp/" & newState)

    Set uidoc = uiws.CurrentDocument()
    Set doc = uidoc.Document
    Call doc.ReplaceItemValue("LampState", res)
    Call uidoc.Close(True)
    Set uidoc = uiws.EditDocument(True, doc)
End Sub
```

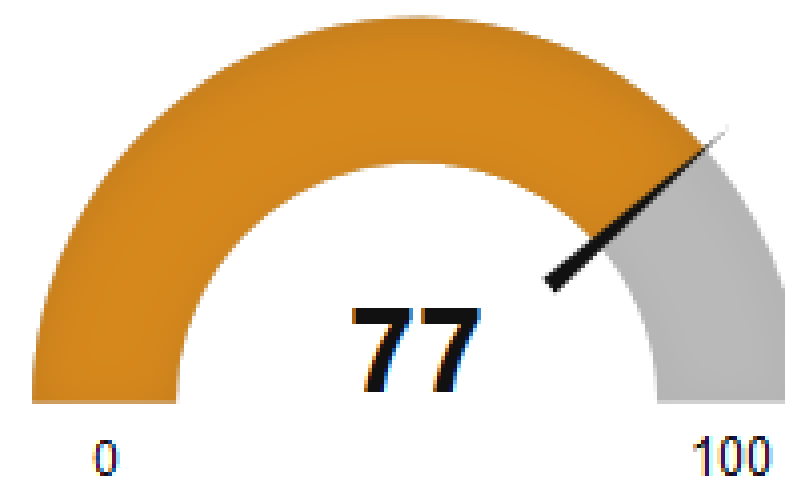
Node-RED flow



Domino-011

Overview

Server Availability Index



RESTART LDAP TASK

Mail

Total pending **1**

Hold **0**

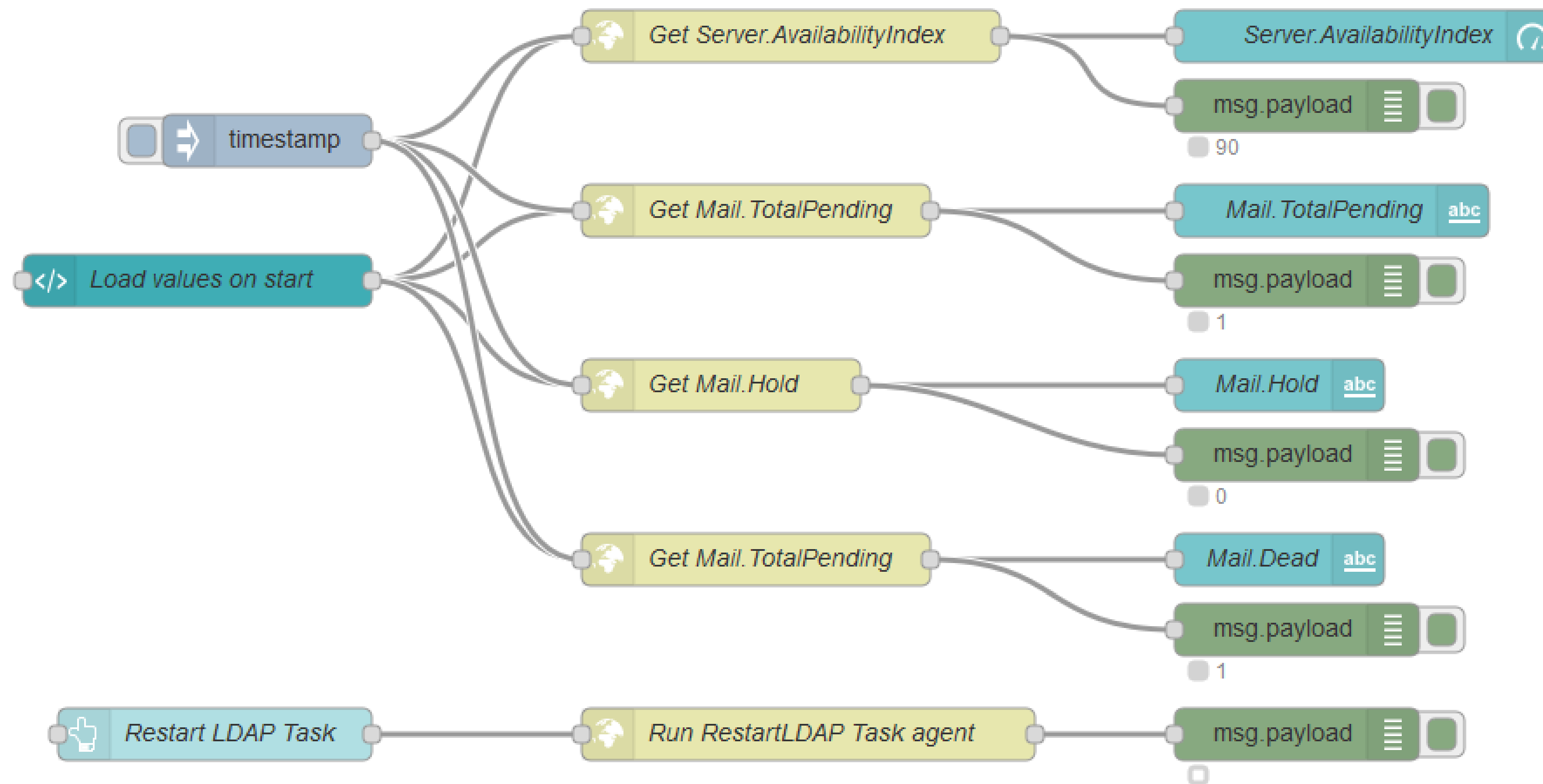
Dead **1**

Demo

Domino Node-RED Dashboard

- Node-RED adapter has dashboard module built-in
- Display and visualize data with gauges, charts, or notifications
- Use UI control elements like buttons, switches, sliders, etc.

Node-RED flow



- Trick: use a template node with this script:

```
<script>
(function() {
  (function(scope) {
    scope.send({payload: Date.now()});
  })(scope);
})();
</script>
```

Sub Initialize

Dim [...]

message = ""

Set contextDoc = session.DocumentContext

statisticName = GetURLParameter("StatisticName") ' utility function to get URL parameter

consoleReturn = session.SendConsoleCommand(currentDB.Server, "sh stat " & statisticName)

statisticValue = StrLeft(StrRight(consoleReturn, statisticName & " = "), Chr\$(10))

Print "Content-Type:text/plain"

Print "Cache-Control: no-cache"

Print FullTrim(statisticValue)

End Sub

Sub Initialize

Dim consoleReturn As String

Print "Content-Type:text/plain"

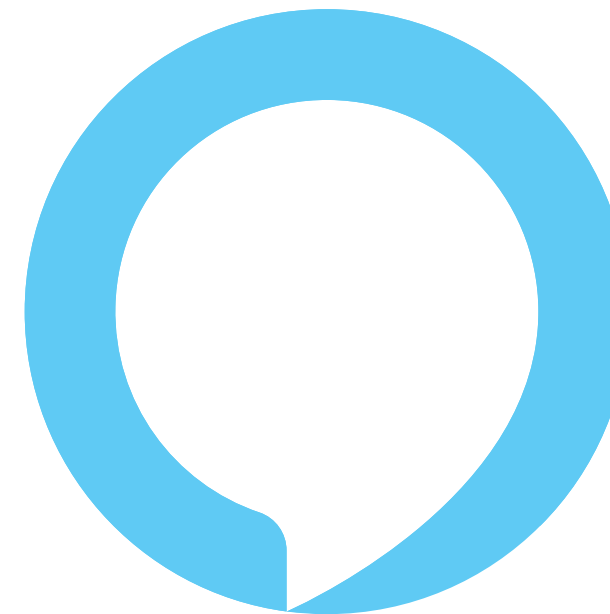
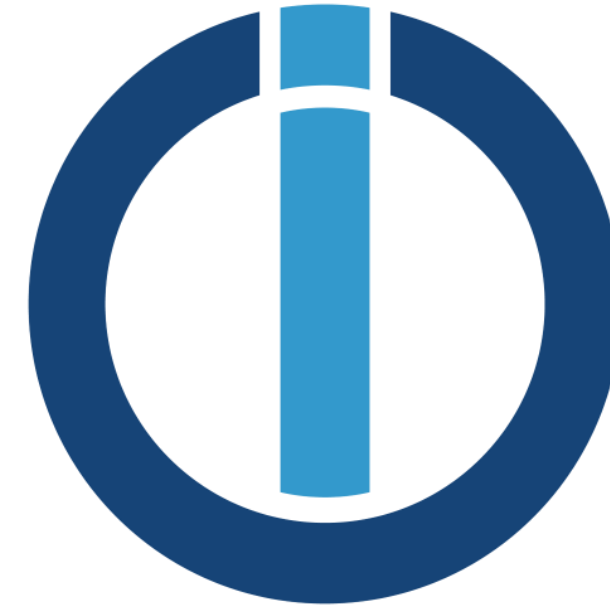
Print "Cache-Control: no-cache"

Print "Restarting LDAP task..."

consoleReturn = session.SendConsoleCommand(currentDB.Server, "restart task ldap")

Print consoleReturn

End Sub



Secret bonus: Add Alexa

Amazon Alexa



- Skill types (limited, but growing):
 - Flash Briefing Skills
 - **Smart Home Skills**
 - Music Skills
 - Video Skills
 - Baby Activity Skills
 - Meetings Skills
 - **Custom Skills**

- Adapter to add Smart Home skill to ioBroker without programming
- Requires ioBroker IoT Cloud adapter (you want the subscription!)
- In Cloud adapter you define rooms and devices accessible from outside.
- Then just let Alexa discover those devices and give commands.

```
restart task ldap >/local/notesdata/rem04521.con
```

LDAP Server: Waiting for all tasks to complete

LDAP Server: All tasks have completed

LDAP Server: Shutdown

LDAP Server: Starting...

LDAP Server: Serving directory names.nsf in the assono.de Internet domain

LDAP Server: Serving directory *****.nsf in the assono.de Internet domain

LDAP Schema: Started loading...

LDAP Schema: Finished loading

LDAP Server: Started

Demo

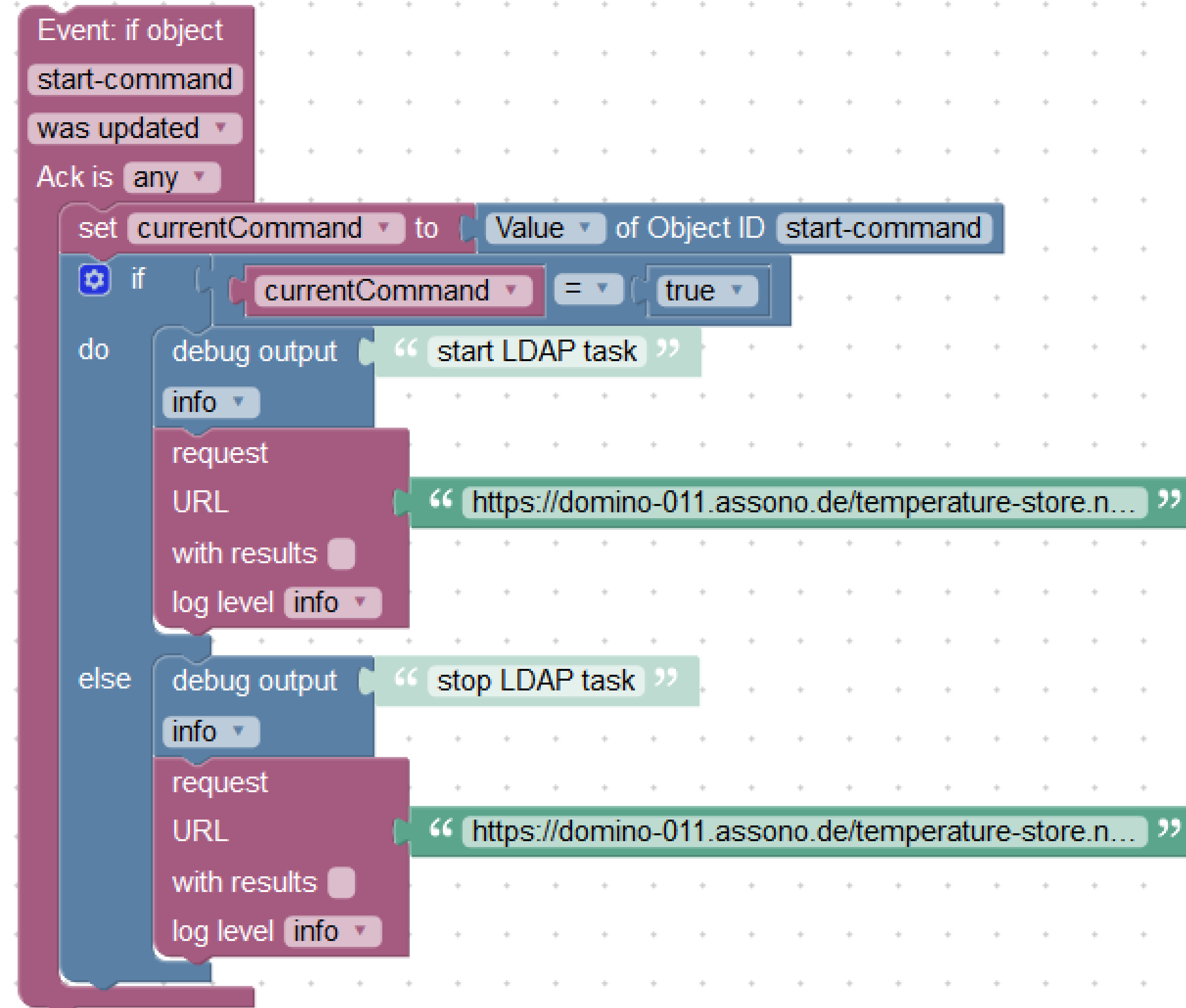
Tell Alexa to get stop and start LDAP task

- Smart Home skills have predefined language model.
- You can't add other verbs, commands, etc.
- I used “turn off” and “turn on”
- The “Trick”: use a **virtual** device
 - Can be switched on and off like real ones
 - Is connected to Domino HTTP task through code

Virtual device in ioBroker



virtual-devices.0								
garage-door	virtual-devices.0.gara...	device						
ldap-task	ldap-task	device						
control	control	channe						
start-command	start-command	state	switch			true		



Sub Initialize

Dim consoleReturn As String

Print "Content-Type:text/plain"

Print "Cache-Control: no-cache"

Print "Starting LDAP task..."

consoleReturn = session.SendConsoleCommand(currentDB.Server, "load ldap")

Print consoleReturn

End Sub

Sub Initialize

Dim consoleReturn As String

Print "Content-Type:text/plain"

Print "Cache-Control: no-cache"

Print "Stopping LDAP task..."

consoleReturn = session.SendConsoleCommand(currentDB.Server, "tell Idap quit")

Print consoleReturn

End Sub

Smart device in iot.0 instance



Adapter configuration: iot.0

OPTIONS SMART ENUMS ALEXA DEVICES EXTENDED OPTIO

+

ldap

×

88. LDAP task
start command

⏻

Smart name for start-command

ID: *virtual-devices.0.ldap-task.control.start-command*

Smart name

LDAP task

You can enter several names divided by comma

SWITCH ▾

Types

OK CANCEL

- Tell Alexa to search for new devices
- Use Alexa to execute command:
 - “Alexa, stop LDAP task”
 - “Alexa, start LDAP task”

- <https://www.iobroker.net/#en/intro>
- <https://github.com/ioBroker>
- <https://www.iobroker.net/#en/documentation>
- <https://de.wikipedia.org/wiki/IOBroker> (no English version)

- [https://en.wikipedia.org/wiki/KNX_\(standard\)](https://en.wikipedia.org/wiki/KNX_(standard))
- <https://www.knx.org>
- <https://www.knx.org/knx-en/for-your-home/real-life-examples/index.php>
- <https://support.knx.org/hc/en-us/articles/360000932564-What-is-the-Falcon-NET-SDK->

We love to help!



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